


June 28, 1956

The **IRON AGE**

The National Metalworking Weekly



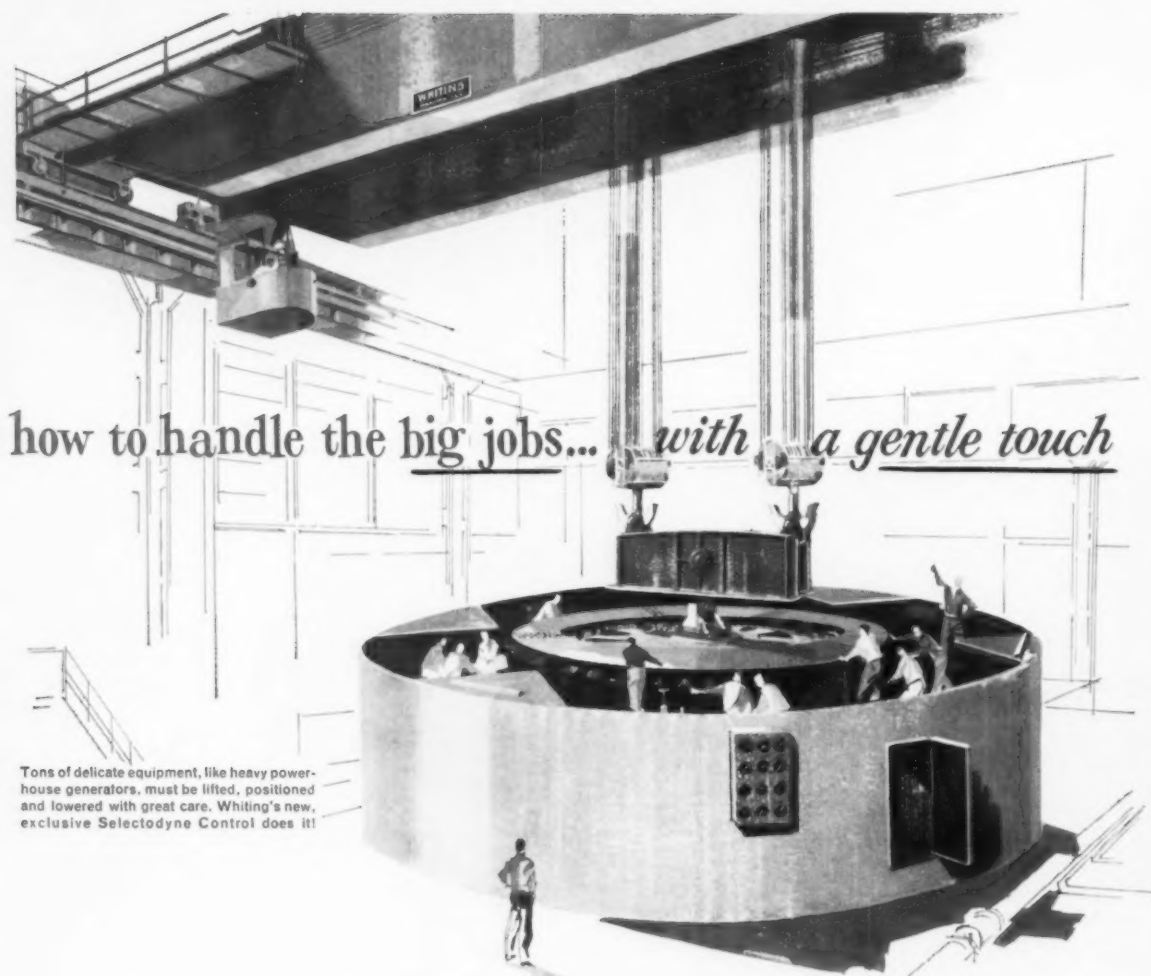
**How to Get
More for Your
Finishing Dollar**

P.97

What Road Program Means To Metalworking P.54

Paper: Its Metalworking Uses Are Growing P.56

Digest of the Week P-2



how to handle the big jobs... *with a gentle touch*

Tons of delicate equipment, like heavy power-house generators, must be lifted, positioned and lowered with great care. Whiting's new, exclusive Selectodyne Control does it!

Industrial management demands a lot from a crane. Rightly so, because a crane represents a major investment. This is why men with many of the nation's largest industries talk over their crane requirements with Whiting engineers before planning plant expansion or crane replacement. After considering all facts, they often choose Whiting Engineered Travelling Overhead Cranes. Why? . . . facts like these: Whiting has over 70 years experience in designing cranes for every type of industry—from power to paper. Whiting cranes permit greater handling precision for large or small loads . . .

from one ton to 450. Whiting cranes keep returning the investment because of their remarkable endurance and extremely low maintenance. It's good business to consult Whiting on your crane requirements.

Heavy handling costs less with a Whiting Crane and our Bulletin No. 80 tells why. Write for it today! If you specify, we will also send interesting crane case studies.

WHITING CORPORATION

15601 Lathrop Avenue, Harvey, Illinois

▼ Fifty-ton capacity Whiting Overhead Crane moves giant press to final assembly area in Danly Machine Specialties, Inc. plant.

This 15-ton capacity Whiting Overhead Crane is in constant use unloading heavy steel plates for Midland Steel Products Co. ▼





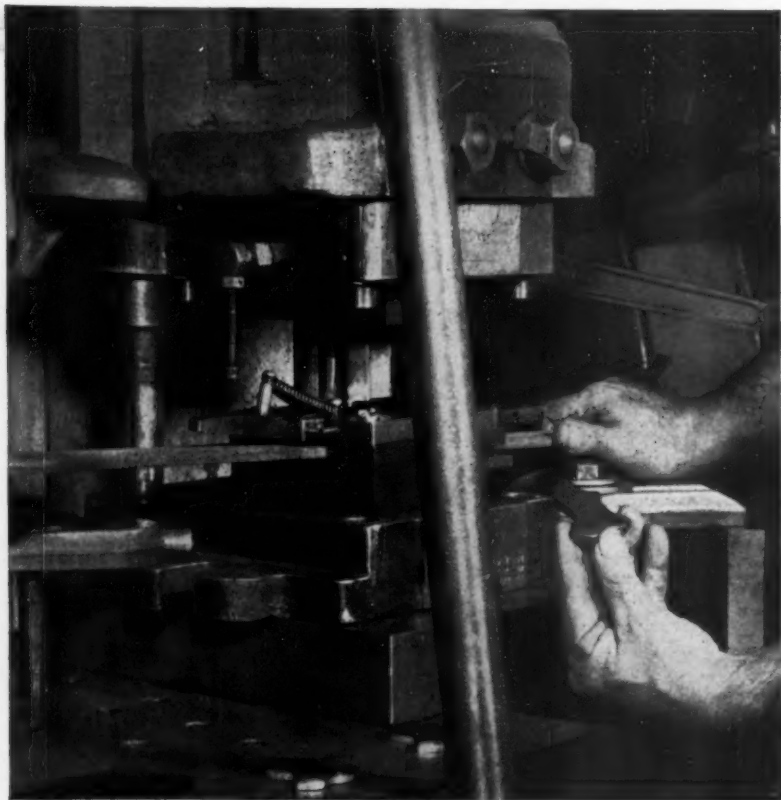
Tool Steel Topics



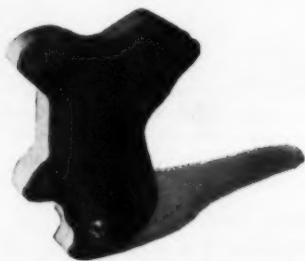
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Blanking Die of Lehigh H Produces 15,000 Shotgun Hammers Between Grinds



A minimum of 15,000 shotgun hammers between grinds, with occasional runs as high as 20,000—that's the kind of performance they're getting with Bethlehem Lehigh H in a blanking operation at Milford Tool & Die Co., Milford, Mass. And the operation isn't easy, for it involves an intricate section, heavy weight of stock, and heavy scale condition.

The die is hardened to Rockwell C 59-60, and operates in a 70-ton press. It blanks S620 hot-rolled alloy steel, $\frac{1}{4}$ in. thick, the finished part looking much like a piece to a jigsaw puzzle. From 0.004 to 0.006 in. is removed in redressing.

Lehigh H is our special-purpose high-carbon, high-chromium tool steel. It is easy to machine, and undergoes minimum distortion in heat-treatment, resulting in high compressive strength. Lehigh H is a deep-hardening steel. It has good wear-resistance, and is safe for intricate dies having sharp corners.

If you would like to try Lehigh H in your shop, you'll find your tool steel distributor anxious to be of service. Call him at any time. Lehigh H may also be obtained direct from our mill depot.

NEW COLOR FILM ON TOOL STEEL

You'll like our new educational motion picture, "Teamwork." The film takes you behind the scenes in describing the manufacture, quality-control, heat-treatment, and end-uses of Bethlehem carbon, oil- and air-hardening, shock-resisting, hot-work, and high-speed tool steels.

"Teamwork" is in color, with sound. It is on 16-mm film, and has a running time of 30 minutes. It's ideal for showing to distributors, die-makers, machine-tool manufacturers, heat-treaters, machinists and technical societies, as well as engineering students.

If you would like to borrow a print, write to Publications Department, Room 1007, Bethlehem Steel Company, Bethlehem, Pa., selecting a showing date as far in advance as possible.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



Multiple Tools Improve Hot-Work Tool Life

All hot-work tools are subject to heat-checking, a type of surface-deterioration consisting of shallow cracks, usually in network form, which lengthen and enlarge gradually during service. The cracks stem from the repeated thermal stress set up each time the tool is used. During use, portions of the tool surface are heated rapidly by contact with the work, causing expansion; subsequently natural cooling, or some type of forced cooling, causes contraction. Repeated cycles of expansion and contraction produce stresses which lead eventually to heat-check cracks which shorten tool life.

If multiple tools are used alternately, the severity of thermal stress in each operation is decreased, thus retarding heat-checking, and lengthening tool life. A typical example is in hot-piercing punches. Often as many as six punches are provided, and used alternately in a rotating fixture which permits rapid placing and removal of the tools. The life of each tool is often doubled in this manner. However, wherever multiple hot-work tools are used, some degree of improvement in tool life may be expected.

June 28, 1956—Vol. 177, No. 26

The IRON AGE

Digest of the Week in Metalworking

Starred items are digested at right.

EDITORIAL

Toward The Lunatic Fringe	7
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NEWS OF INDUSTRY

*Special Report: Steel Stability Forecast	51
*Raw Materials: Tungsten Mines Face Shutdown	52
*Marketing: Heat Pumps Come of Age	53
*Transportation: Highway Program Gets Underway	54
*Packaging: Paper Finds Metalworking Market	56
*Publications: Plant Mags Are Moneysavers	60
Metalworking Briefs	184

NEWS ANALYSIS

Newsfront	49
Report to Management	65
Automotive Assembly Line	68
*This Week in Washington	73
West Coast Report	77
Machine Tool High Spots	79

TECHNICAL ARTICLES

How To Get More For Your Plating Dollar	97
Metal Cleaning and Finishing Handbook	105
Technical Briefs	88

MARKETS & PRICES

*The Iron Age Summary—Steel Outlook	159
Steel Products Markets	156
Comparison of Prices	161
Iron and Steel Scrap Markets	162
*Nonferrous Markets	166
Steel Prices	169

REGULAR DEPARTMENTS

Dear Editor	9
Fatigue Cracks	11
Dates to Remember	13
Free Literature	150
New Equipment	156

INDEX TO ADVERTISERS	184
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THE IRON AGE, published every Thursday by CHILTON CO., Chestnut & 56th Sts., Philadelphia 39, Pa. Entered as second class matter, Nov. 8, 1932, at the Post Office at Philadelphia under the act of March 3, 1879. Price to the metalworking industries only, or to people actively engaged therein, \$5 for 1 year, \$8 for 2 years in the United States, its territories and Canada. All others \$15 for 1 year; other Western Hemisphere countries, \$15; other Foreign Countries, \$25 per year. Single copies, 50¢. Annual Review Issue, \$2.00. Cable: "Ironage," N. Y.

Address mail to The IRON AGE
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NEWS DEVELOPMENTS

STABILITY IN STEEL LABOR FORECAST

P. 51

Some good will come out of the fracas over steel labor negotiations. Chances are there will be a compromise on the union's demand for a one-year pact and steel's proposal of a five-year contract. A longer-term agreement would bring needed stability.

DOMESTIC TUNGSTEN MINES FACE SHUTDOWN

P. 52

High labor costs puts U. S. producers in unfavorable position in world market. Uncle Sam, the industry's only customer, has finished its stockpiling program. Legislation on tap to extend federal buying 30 months.

PAPER FINDS MARKET IN METALWORKING

P. 56

Metalworking finds paper is valuable in protective wrapping. Chemically

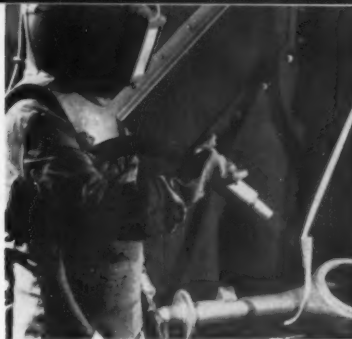


treated, it provides good protection against corrosion. One steel mill buys \$20,000 worth of paper a month for interleaving steel sheets.

PLANT PUBLICATIONS ARE MONEYSAVERS

P. 60

The ways in which a house organ can save a company money are numerous. Here a seasoned editor lists helpful suggestions that he has seen work out profitably for many an enterprising firm.



BLAST CLEANING prepares this part for next operation. Method is one of many covered in special 'Finishing Dollar' feature beginning P. 97 (see summary below). Clark Equipment Co. photo.

WHAT WILL CIVIL DEFENSE "ALERT" SHOW?

P. 73

July exercise will tip off what measures government would take in case of emergency. Actual copies of control orders will be used. Extent will depend on how serious an emergency is planned by civil defense authorities in practice alert.

SPECIAL FEATURES

HOW TO GET MORE FOR YOUR FINISHING DOLLAR

Modern plating shops—up against multiple problems—realize that in the very complexity of their operations lie the seeds for greater cost-cutting opportunities. Alert platers keep a constant eye peeled for ways to pare costs, improve efficiency. Here's a roundup of expert opinion on where to look and what to do, from design stages through the finished product, to stretch the finishing buck.

MONEY-SAVING STARTS WITH MANAGEMENT

Pulling plating practice up by the boot straps has to be done from a vantage point above the shop foreman level. It's up to management to get interested and pass the word down, if its thinking is to be reflected by every plater. This means more than token approval. It means a thorough-going, studied approach to the problem—and the help of experts where needed.

PLANT MAINTENANCE IS AN IMPORTANT AREA

Others of importance in studying how to cut finishing costs are layout, peculiarities of product design, water supply, plating wastes and methods of handling them, to name a few. Collect your facts on each operation, then look at each critically.

METAL CLEANING AND FINISHING HANDBOOK

Up-to-date tabular information in six sections will help the metalworker select, evaluate and specify the right cleaning or finishing method for a particular use. Latest specifications, changes in standards aid in this. New charts and tables bring the handbook to you with accurate-to-last-week information. You'll find 24 individual tables plus other helpful information spanning the finishing field.

SELECTING THE RIGHT FINISH FOR YOUR SHOP

Separate sections help solve ticklish metal cleaning or finishing problems in large and small shops. Topics covered include surface treating, cleaning and pickling, paints, lacquers and other organic coatings, mechanical finishing, rust preventives and metallic finishes.

MARKETS AND PRICES

HEAT PUMPS:

THEY'VE NOW COME OF AGE P. 53

New technical developments pave way for large scale use of these units for home and industrial heating and cooling. Growing sales reaching cumulative total of 861,000 units by the end of 1965 are foreseen.

NEXT WEEK:

SMALL BUSINESS NEEDS STEEL LABOR POLICY

Harold J. Rutenber, steel union official turned industrialist, says small business gets short end of the stick in following "pattern" set by basic steel labor contracts. He presents a compelling case for consideration of small business's viewpoint.

FEDERAL HIGHWAY PROGRAM GETS UNDER WAY

P. 54

41,000-mile system of interstate highways gets approval. It will mean higher highway taxes, but should pay for itself in lower long range transportation costs. Congress authorizes first \$32.9 billion, but that figure is only a starter.

SUCCESSFUL MARKETING DEMANDS RESEARCH

P. 58

Modern business needs highly specialized research programs to keep up with market trends and abreast of all the complex economic factors. New product developments are important. Many of today's products were not even developed 10 years ago.

WEEK OF UNCERTAINTY FOR STEEL USERS

P. 159

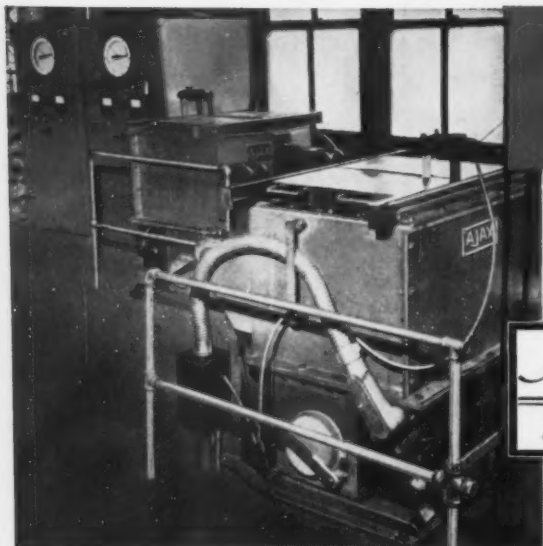
Steel consumers were on tenter hooks in this critical week of the steel labor hassle. Even a last-minute settlement would mean steel losses some users could ill-afford. A strike would be disastrous.

ALL QUIET ON THE COPPER FRONT

P. 166

Fear of a major strike has virtually been eliminated. Three major producers have inked new pacts with unions. Kennecott signing delayed. Odds on a price cut are about 80-20.





View above shows AJAX melting furnaces, with control cabinets in background.

AJAX INDUCTION FURNACES

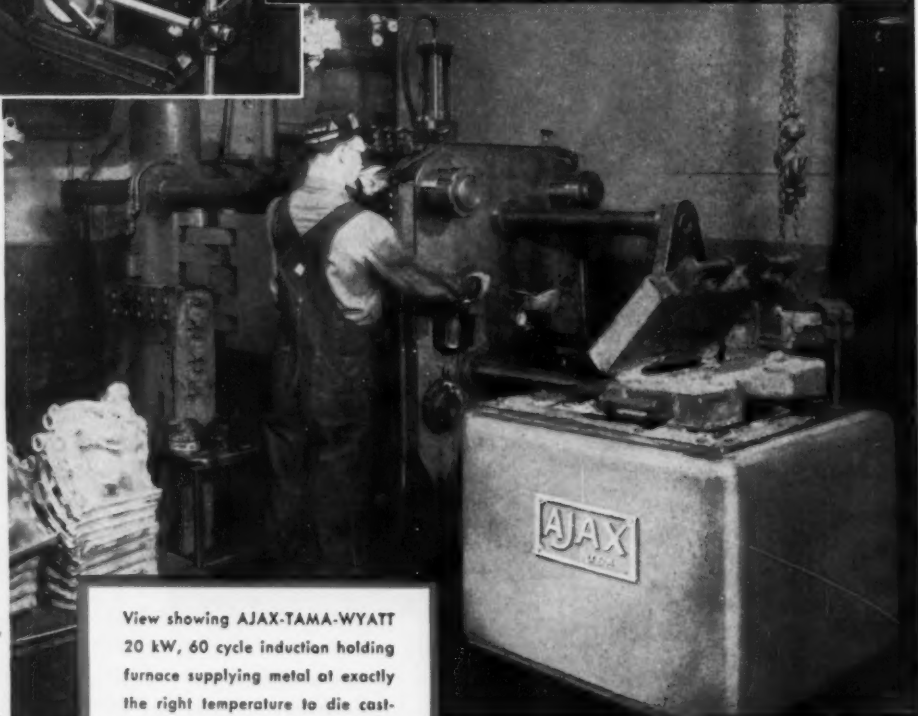
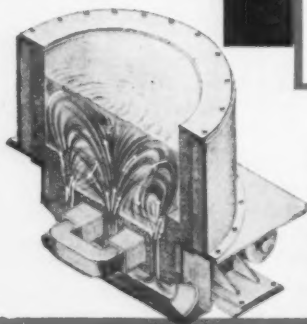
mean Higher Quality Castings for...

Advance
TOOL & DIE CASTING COMPANY

Aluminum DIE CASTINGS Zino Base

The Furnace That Stirs Itself...

The sectional view below shows the twin-coil stirring action of the 100 kW, 60 cycle AJAX Induction Furnace. Heat induced in the secondary channels below is conveyed throughout the melt by electro-magnetic circulation, as shown by the arrows.



View showing AJAX-TAMA-WYATT 20 kW, 60 cycle induction holding furnace supplying metal at exactly the right temperature to die casting machines.

Inherent stirring action of these furnaces has proved most valuable to ADVANCE TOOL & DIE CASTING CO., Milwaukee, Wisc. In full operation for 3 years, the most important result of the use of these furnaces is higher quality die cast aluminum parts. The alloy is held in uniform solution, resulting

in elimination of oxides, reducing hard spot trouble in secondary machining to a negligible factor. Temperature of the melt is held at 1170° F. through on-off control of the low power circuit. Working conditions are made more comfortable because of low heat losses. The units take up very little floor space.

AJAX

TAMA-WYATT

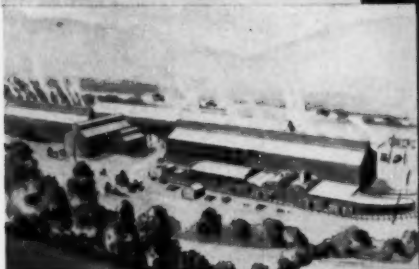


AJAX ENGINEERING CORP., TRENTON 7, N. J.

INDUCTION MELTING FURNACE

AJAX ELECTRO-METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax-Inducto High Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax-Inducto Electric Tool Steel Furnace
AJAX ELECTRIC FURNACE CORP., Ajax-Inducto Induction Furnaces for Melting

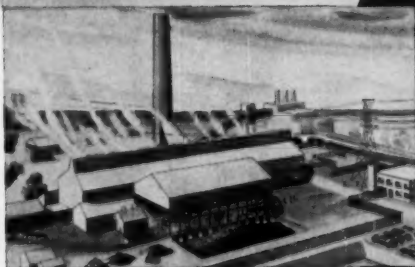
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June 28, 1956

EDITORIAL

Toward the Lunatic Fringe

♦ THERE IS A LOT to the old saying that you can run a good thing into the ground. And it is still true that generally you can't have your cake and eat it too. But we seem to be trying to run a good thing into the ground—and still eat and have our cake.

We are referring to labor fringe benefits. Almost every contract now being closed has new versions of it. A lot of people are wondering if all of this is really worthwhile.

Chances are most people forget for what purpose fringe benefits were granted. To union chiefs they were good talking points, "fine" for the workers and showed the labor bosses were on the job.

To management, fringes appeared to be good for morale and increased productivity. Up to a point all of this was true. Also, management often had no choice in the matter if it wanted to avoid a strike.

Maybe we are heading for the "fringe of all fringes"—the lunatic fringe. If demands keep up and more and more firms agree to 65 or 60 pct supplementary unemployment benefit plans, do you think it will stop there? Hardly!

The ultimate goal on SUB is 100 pct payment for time not worked due to a layoff. When we get to that point it will be pretty hard to get a fellow to work when he can get paid for loafing. Far fetched? Not if you listen to the experts who have calmly watched the onward parade.

Let's get off this high level industrial relations chatter. Does the worker really want all this new fangled stuff? Or is it a big dish cooked up by the union?

Sure the worker wants all the fringe he can get. But he no longer counts this as wages. It is gravy—if he gets a big wage increase too. Most workers (idealists please note) want the "green stuff" and not the fine print. When the "benefits" get so costly that the wage increases get increasingly lower, they say "no soap."

Fringes are reaching the point of no return. They do nothing for management—and workers take them for granted. From here on out they will be something dreamed up by the labor leaders as a new and many-hued feather for their caps.

Labor people know this; do you?

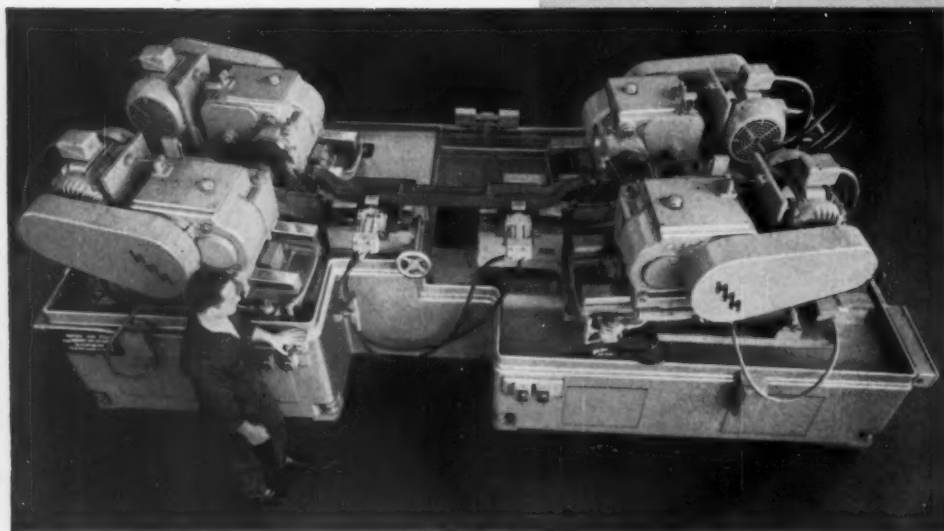
Tom Campbell

EDITOR-IN-CHIEF

MIGHTY BIG JOB

MINIMIZED by another

MOTCH & MERRYWEATHER *Production Solution*

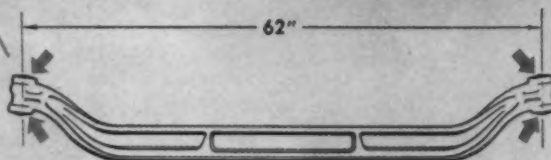


Traveling head universal double duplex milling machine.

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universality into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

*Write for Bulletin S-56 describing
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dear editor:

letters from readers

Beautiful Job

Sir:

I would appreciate very much having six reprints of the editorial "Salesmen are People Too!" from the April 19 issue.

I only saw the editorial last Friday and I feel that it is beautifully and truly done and I do want these copies for our department. *H. Van Straaten, Van Straaten Chemical Co., Chicago, Ill.*

Joy and SUB

Sir:

In the May 24 issue of THE IRON AGE, I read with interest the very worthwhile article "All Isn't Joy As SUB Payments Start."

May I have six reprints of this article by return mail as I believe others in our organization would be interested in reading this enlightening article. *O. W. Roberts, Purchasing Agent, Lion Mfg. Corp., Chicago, Ill.*

Chem Milling

Sir:

The June 7, 1956, issue of THE IRON AGE contains an article entitled "New Techniques in Aircraft Machining," which briefly describes a new process called "Chemical Milling."

Will you kindly advise me where I can receive additional information on this subject? I am interested to know what equipment is necessary for this process, the manufacturer and details of the manufacturing steps which are involved. *R. L. Jones, Manufacturing Research, Dept. 587, International Business Machines Corp., Poughkeepsie, N. Y.*

For more information get in touch with Mr. C. F. Devine, Sales Promotion Mgr., Turco Products, Inc., P.O. Box 2649, Terminal Annex, Los Angeles 54, Calif.—Ed.

Chicago Stirs Interest

Sir:

In May 17 issue of THE IRON AGE an article appears on page 56 entitled "Steel: What Will Price Probe Show?"

And also in the same magazine, page 51, appears an article entitled "Chicago: Metalworking Leader" that is very interesting. Would you kindly include two additional copies of both articles for our use? *H. B. Wollison, Vice President, The Commercial Shearing and Stamping Co., Youngstown, Ohio.*



Sir:

I would appreciate it very much if you would send me a reprint of your article "Chicago: Metalworking Leader" which appeared in the May 17 issue of your magazine. *D. W. McGill, Mgr., Steel Mill & Metal Working Section, Industrial Sales Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.*

Are We Going Soft?

Sir:

Would you be good enough to furnish me with a half-dozen copies of the Editorial "Are We Going Soft?", and the article "Campus Recruiting", page 105, which appeared in THE IRON AGE of May 24. *G. D. O'Neill, Ass't to Chief Engr., The Baltimore and Ohio Railroad Co., Engineering Dept., Baltimore, Md.*

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Digest of the Week in Metalworking

help you find your favorite features.

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METAL TO METAL FASTENINGS STAY TIGHTER WITH TENSION



RELIANCE SPRING LOCK WASHERS

Metal products assembled by the tried and true nut/bolt method need more than just tight fastenings at the end of the production line. This especially is true of products subject to movement, vibration, stresses and strains. Metal wears, bolts stretch; and a fastening can become loose even though the nut doesn't turn. One solution to this problem is the application of constant tension to the assembly supplied by Reliance Helical Coil Spring Lock Washers.

These are the same high quality Spring Lock Washers on which the metal working industry has depended for forty-two years. They are made of cold drawn spring steel and are quality controlled throughout the manufacturing operation. For the complete story, write for your free copy of Reliance Engineering Bulletin W-50.



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fatigue cracks

by William M. Coffey

Fifty Years

Last week found us pounding the boardwalk at Atlantic City. No, we were not asked to judge a beauty contest (though we're open to invitations.) The American Society of Testing Materials (ASTM) held its fifty-ninth annual meeting. Committees concerned with the standards for everything from asbestos to zinc were hard at work on industry's material problems. There were a few breaks for refreshment, however. And at one of them—the President's luncheon—THE IRON AGE was awarded a very handsome certificate in recognition of its 50th year of continuous membership in the society.

Naturally, we're proud of this distinction and of our long-standing editorial policy of close cooperation with, and participation in, the technical societies of the metalworking industry. It's paid dividends many times over by helping us to keep abreast of all of the latest technical developments, developments our readers want to know more about.

One such development turned up in the form of a technical paper at one of the ASTM evening sessions. Its authors, F. C. Monkman and

N. J. Grant, were represented in our technical section a few weeks ago with a very fine article on low-carbon, low-nitrogen stainless steels.

Four-Minute Mile

A look at No. 5 in our metalworking dollar series on p. 97 this week makes us feel a bit like Ron Delaney, 21-year-old track star who recently cracked the four-minute mile. Interviewed in Berkeley, Calif., Delaney commented: "It's a funny thing. Once you run a four-minute mile, people expect to see you do it every time you go out." After you read the special feature on metal finishing, we hope you'll feel we've hit another high mark with our readers.

New Puzzler

A farmer has a cow which he tethers to the end of a rope 110 ft long. The rope is attached to a corner of the barn which is rectangular and measures 40 ft by 60 ft. Disregarding the thickness of the rope and considering 110 ft as the extreme distance the cow can reach, what is the total grazing area around the barn?

American Society for Testing Materials

ORGANIZED
1895



INCORPORATED
1902

In recognition and appreciation of
Fifty Years
of continuous membership in the Society
this Certificate is awarded to

The Iron Age

By action of the Board of Directors

June 18, 1956

[Signature]
President

[Signature]
Secretary

PHOSPHOR BRONZE

a tough, resilient, corrosion
resistant alloy... is a vital
part of our daily living...



ELECTRIC MOTORS

... run better and longer
with bearings and wearing
parts of Elephant Brand phosphor
bronze.



SWITCHES

... owe much of their life
and usefulness to fatigue
resisting parts of Elephant
Brand phosphor bronze.



SPRINGS

... hold their temper and
bounce longer and better
when they are made of Ele-
phant Brand phosphor bronze.



MARINE EQUIPMENT

... resists water and weather
with engine parts and hard-
ware of Elephant Brand phos-
phor bronze.



ELECTRONIC EQUIPMENT

... functions accurately and
efficiently with components of
Elephant Brand phosphor
bronze.

The purest phosphor bronze
bears either of these two marks



Elephant Brand



SEYMOUR

THE SEYMOUR MANUFACTURING COMPANY

Parent Company To The Phosphor Bronze Corp.
2 Franklin Street, Seymour, Connecticut

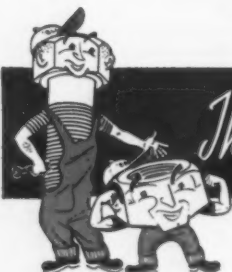


In a Mess? CALL "ELL" AND "ESS"!

The best laid new product plans sometimes bog down because of fastening problems.

On paper the product looks good—*is* good . . . is designed in every way for efficiency and salability.

But putting it together may be another story. Special type bolts or nuts may be required to do the job right. Whenever a "crisis" like this turns up, call in "ELL" & "ESS", the helpful Lamson & Sessions "can do" pair. They can engineer the required fastener, they can make it and many times they save you money.



The **LAMSON & SESSIONS Co.**

1971 West 85th Street • Cleveland 2, Ohio
PLANTS AT CLEVELAND AND KENT, OHIO • BIRMINGHAM • CHICAGO

dates to remember

JULY

TRUCK-TRAILER MANUFACTURERS ASSN., INC.—Summer meeting, July 19-20, Edgewater Beach Hotel, Chicago. Society headquarters, 710 Albee Bldg., Washington, D. C.

NATIONAL TOOL & DIE MANUFACTURERS ASSN.—Summer meeting, July 25-28, Estes Park, Colo. Society headquarters, 907 Public Square Bldg., Cleveland.

CUTTING TOOL MANUFACTURERS ASSN.—Quarterly meeting, July 25, Lochmoor Country Club, Detroit. Society headquarters, 416 Penobscot Bldg., Detroit.

EXPOSITIONS

WESTERN PACKAGING AND MATERIALS HANDLING EXPOSITION, July 10-12, Los Angeles.

ASSN. OF IRON & STEEL ENGINEERS, Sept. 25-28, Cleveland.

METAL SHOW—Oct. 8-12, Cleveland.

AUGUST

SOCIETY OF AUTOMOTIVE ENGINEERS, INC.—National west coast meeting, Aug. 6-8, Mark Hopkins Hotel, San Francisco. Society headquarters, 29 W. 39th St., N. Y.

NATIONAL SCREW MACHINE PRODUCTS ASSN.—Annual national sales conference, Aug. 7-8, Wade Park Manor Hotel, Cleveland. Society headquarters, NSMPA Bldg., Cleveland.

WESTERN ELECTRONIC SHOW AND CONVENTION—Aug. 21-24, Pan Pacific Auditorium and Ambassador Hotel. Information, WESCON, 344 N. LaBrea Ave., Los Angeles.

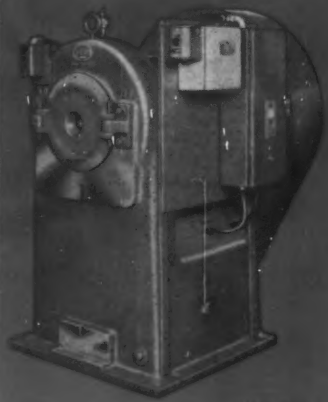
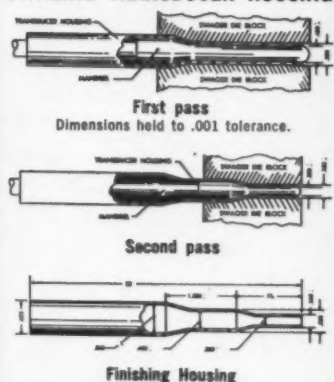
SEPTEMBER

METAL POWDER ASSN.—Fall meeting, Sept. 7-9, Homestead, Hot Springs, Va. Society headquarters, 420 Lexington Ave., N. Y.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS—Fall meeting, Sept. 9-12, William Penn Hotel, Pittsburgh. Society headquarters, 120 E. 41st, N. Y.

ARE YOU MACHINING **when** you should be **SWAGING?**

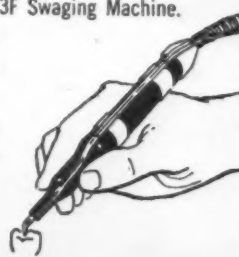
SWAGING TRANSDUCER HOUSING



How **SWAGING** cuts costs 80% on Transducer Housing

The Cavitron Ultrasonic Dental Unit provides a marvelous new method for preparing cavities without noise, vibration and heat which contribute so greatly to dental pain and discomfort. Internal dimensions of the transducer housing are critical. A mating cap requires the outside diameter to be rigidly held as well. This housing was formerly machined in two parts and silver brazed together. Now, it is made in one piece from tube stock in 2 passes on a Fenn Model 3F Swaging Machine.

RESULT—Cavitron has not only reduced cost of the Transducer Housing 75% to 80% but now has a simplified one-piece housing that is stronger, easier to make and with a smooth, bright surface resulting from swaging which requires no additional finishing. Write for catalog and full information.



FENN

SWAGING

may have important advantages and savings in the manufacture of your products. Fenn engineers are at your service.



Precision Rolling Mills



Turks Heads



Wire Shaping Mills



Swaging Machines



Wire and Tube Drawing Machines

FENN MANUFACTURING CO., 304 Fenn Road, Newington, Connecticut

Precision Tooling

shortest route
to COST
REDUCTION



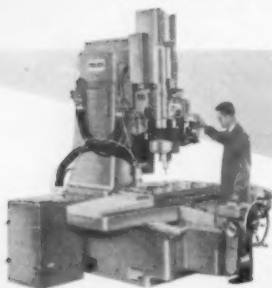
P & W

KELLER MACHINES

Producing an almost limitless variety of dies, molds, prototypes and other work, these automatic, tracer-controlled millers accurately reproduce the shape of any 2-dimensional template or 3-dimensional full model. Complex forms that cannot be machined economically — or at all — by other methods are produced quickly and easily by "Kellering."

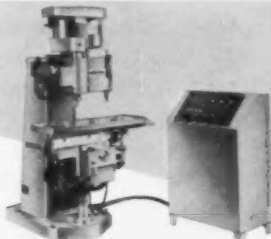
PRATT & WHITNEY COMPANY, INCORPORATED

MACHINE TOOLS • GAGES • CUTTING TOOLS



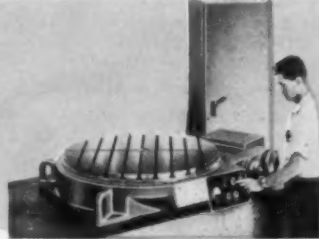
2E VERTICAL PRECISION HOLE GRINDER

"Tenths" accuracy plus grinding speeds to 100,000 rpm.



"VELVETRACE" MILLING MACHINE

Ultimate in accuracy for 3-dimensional tracer-controlled reproduction.



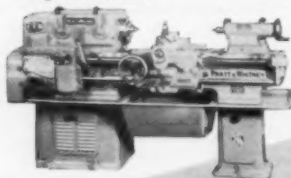
PRECISION ROTARY TABLES

Rugged, accurate to seconds! Automatic, plain, tilting and vertical types; 10" to 50" diameters.



PLAIN AND UNIVERSAL DIE SINKERS

Extra power and stamina to handle today's tougher die steels with speed, accuracy.



MODEL C LATHES

Traditionally the finest wherever highest precision is essential . . . now even better.



CUTTER and RADIUS GRINDERS

Grinds virtually every type of standard and special cutter . . . quickly and accurately.

To meet today's standards for quality and performance . . . and to compete profitably on today's markets . . . your products must be manufactured with a greater degree of precision than ever before. The only sound, economical way to meet these high standards is to build precision into your products where production starts . . . in your tool room with Pratt & Whitney Machine Tools . . . your assurance always of the finest, the most accurate.



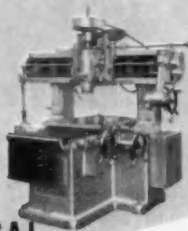
P & W

JIG BORERS

Locating, boring and checking to .0002 of an inch, P&W Jig Borers are primarily designed to bring new standards of dependable accuracy to the manufacture of basic production tools such as jigs, fixtures, dies, molds, etc. However, unequalled speed and ease of operation have led to widespread use for precision small-lot production; for fast, accurate inspection work; and for a variety of precision machining jobs where other types of machines would require complicated jigs and fixtures.

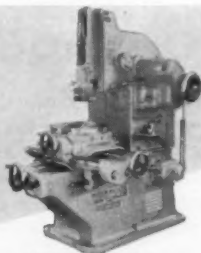
WEST HARTFORD, CONNECTICUT

Direct Factory Representatives in Principal Cities



VERTICAL MILLERS AND PROFILERS

Economical production profiling of irregular shaped parts.



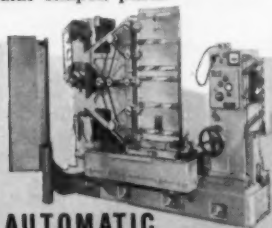
VERTICAL SHAPERS

Handiest machine in any shop for fast, accurate handling of irregular shaped work.



DIAFORM WHEEL FORMING ATTACHMENTS

Form-trues grinding wheels, accurate to "tenths" in minutes; saves time, money.



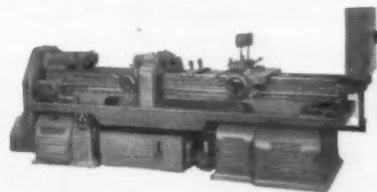
AUTOMATIC DUPLICATING MACHINES

Duplicates die and bottle mold sections . . . quickly, accurately, economically.



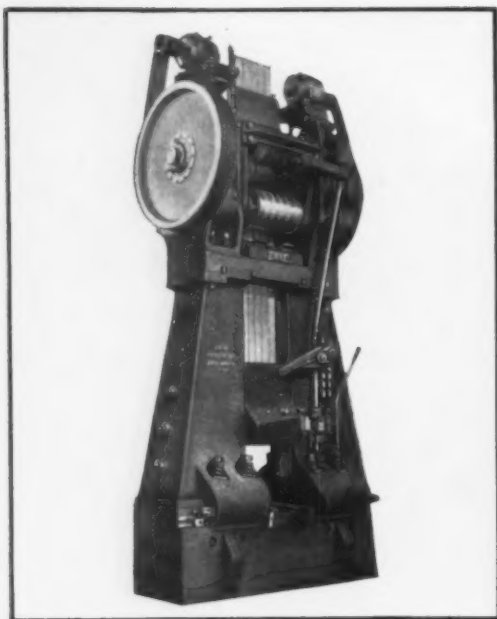
MODEL C THREAD MILLERS

Unusually versatile; sets new standards for accuracy, finish and economy.



DEEP HOLE DRILLERS

Twin drilling units produce true holes up to 129" deep in a single, uninterrupted operation.



"Gee, Dad--I bet you forged it in one impression on that big 10,000-lb. Board Drop Hammer!"



let your
Youngsters
learn about
FORGING

If you have a raft of kids—send for a raft of books:

ERIE FOUNDRY CO., ERIE, PA.

Send "FORGELAND U.S.A." Books to:

NAME _____

FIRM _____ TITLE _____

ADDRESS _____

CITY _____ STATE _____

Quiz kid? Mmm, not exactly. It's that Erie Foundry book in his back pocket that did the trick.

What? A forging book for *kids*?

Well you see, we've been thinking that it would be kind of nice to have the youngsters (yours and ours) understand this forging business a little. Might make them think Pop's *almost* the man Superman* is.

So we poor, unsung fathers at Erie had the exciting story of "Forgeland, U.S.A." put in a book—in the kind of language youngsters understand—with pictures too!

And you're welcome to a copy—or several . . . for free, of course. **absolutely guaranteed to make Pop a hero*

ERIE

ERIE FOUNDRY CO. ERIE, PA.

"OUR 61st YEAR"

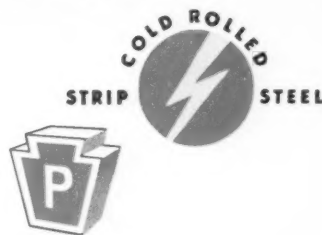
FORGING HAMMERS • TRIMMING PRESSES • HYDRAULIC PRESSES AND ALLIED EQUIPMENT



Pattern Design Strip—"Thomas Strip is the only company that can supply our requirements for Pattern Design plated strip," says an official of Milwaukee's M. A. Gerett Corp., world's largest manufacturer of fine coin banks like those shown above in assembly. Thomas' lacquered copper, brass and nickel coated strip cut M. A. Gerett's rejection rate 7 percent. Piece buffing at Gerett was eliminated through adoption of Thomas' Pattern Design Strip. Die life increased, too, because the strip's coating acts as a lubricant during the forming operation, yet doesn't crack.



Brass—Gleaming brass coated strip from Thomas offers manufacturers electrolytically pre-coated steel with a finish that can be oxidized readily to a variety of shades. Subsequent lacquering gives an attractive and permanent final product finish. Here is steel's strength and economy with the advantages of brass. It protects parts-in-process against corrosion and lends itself readily to production of small stampings, drawn parts, tubing and roll-formed sections. Available in natural, planished and buffed finishes in a variety of widths, tempers and gages.



You Can Bank On Saving Money With *Thomas Strip* Pre-coated Steel

Manufacturers using Thomas Strip—pre-coated with zinc, copper, brass, nickel, tin or lacquer—are piling up big dollar savings.

These fabricators are reducing their production costs... stretching supplies of hard-to-get, expensive metals... and making their finished products more competitive and attractive.

Pre-coated steel specialties from the Thomas Strip Division of Pittsburgh Steel Company come to you already electroplated with zinc, cop-

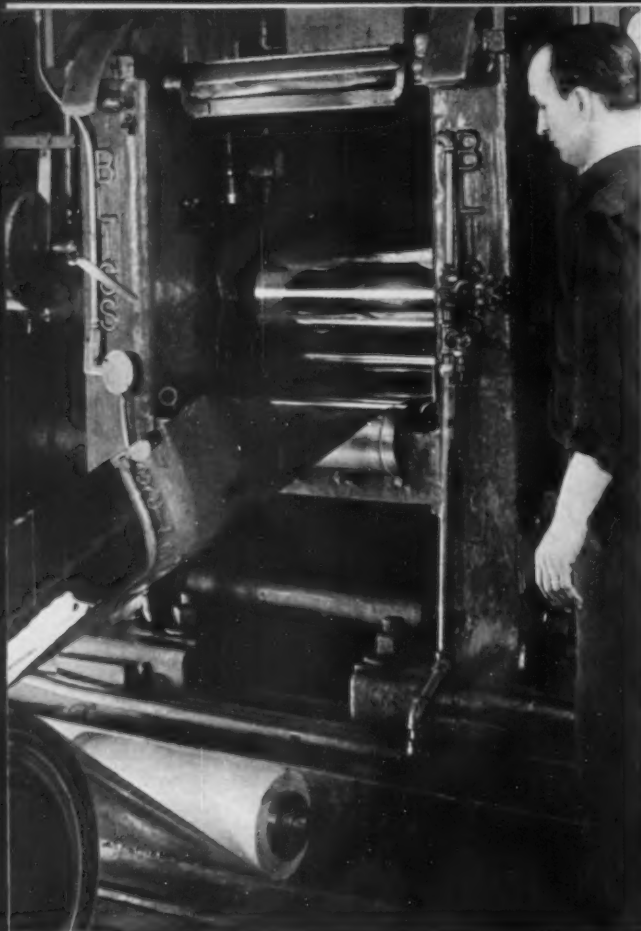
per, brass or nickel. Or you can get them hot dip coated with lead alloy or tin. Natural, planished or buffed finishes are available. Lacquer coatings are furnished in a full range of colors or in clear lacquer. Thomas also can supply you close tolerance plain steel strip in a variety of tempers, grades and finishes.

Thomas Strip has long been recognized for precision rolling to extremely close tolerances in gages down to .004 inch and up to 22 inches in width. Tempers include 1,

2, 3, 4 and 5, or special tempers as required. You can get Thomas Strip in oscillated or ribbon-wound coils or in cut lengths. A choice of edges is available to meet your exact specifications.

Don't overlook the possibilities of Pattern Designed rolled strip which Thomas produces in an almost unlimited variety of patterns in coated and uncoated finishes. Turn the page to see how other manufacturers are cutting costs with Thomas Strip products.

HOW PRE-COATED THOMAS STRIP SAVES YOU MONEY



Nickel Coated Strip—Loose Leaf Metals Co. of St. Louis is one of the largest manufacturers of metal hardware for binders and loose leaf books. Photograph shows production of a metal part for a first grade ring metal. President George A. Ober says: "We have never experienced a flaky surface on a Thomas product. We've come to know Thomas will not ship until its product is right, therefore, we have never had to reject their materials." Thomas is a major supplier of cold rolled nickel, copper, tin, zinc and lacquer coated steel.

Plain Steel—Bright uncoated steel strip in low carbon, alloy and spring steel grades, has uniformity of temper, gage and finish. Above, plain cold rolled steel passes through a temper mill at the Thomas Strip plant. In addition to high finishes, Thomas Strip is available in dull and regular finishes, in coils or cut lengths—in a choice of edges—and a range of specifications.

Here's Why You Cut Costs With *Thomas Strip*



Copper Coated Strip—Here's the evolution of a Ray-O-Vac flashlight—from electroplated copper strip, produced by Thomas Strip, to the finished product. Blake Manufacturing Division of Ray-O-Vac Company at Clinton, Mass., changed from brass to steel for this and other flashlight cases. Production savings from 17 to 29 percent resulted. Ray-O-Vac uses a .020 gage, non-scalloping, deep drawing quality strip steel produced by special processing techniques. The steel is electro-copper coated on both sides, and is 6 $\frac{3}{16}$ inches wide. On three popular models alone, the savings amounted to more than \$100,000 in one year.

- **Thomas Strip Fabricates Easily**—Coatings stand fully as much fabrication as the easy-to-work base steel.

- **Die Life Is Lengthened**—Most coatings lubricate dies, reduce wear.

- **Gives Maximum Pieces Per Pound**—Because Thomas Strip is rolled to extremely close tolerances, you get the maximum number of parts per pound of metal.

- **Cuts Plating Costs**—Thomas coatings can serve as a final product finish or as a prepared base for further plating or painting.

- **Your Manufacturing Processes Are Streamlined**—Ready-to-fabricate Thomas Strip streamlines your manufacturing processes to two essentials—fabricating and assembly.

- **Extends Economy Of Steel To Many Parts**—Pre-coated Thomas Strip replaces more expensive metals.

- **You Can Begin To Save Today**—Experienced Thomas metallurgists and technicians are available now to help you with your steel problems. Their help is yours for the asking. Write or call any Pittsburgh Steel Company sales office.



Zinc—Long "strips" of Thomas zinc-coated steel hold the vegetable fiber in Fuller Brush Co.'s power-driven brushes shown above. In foreground is an industrial brush used to process plywood. The brush in the background is for an automobile washing machine. Although zinc-coated steel undergoes a severe deformation in forming machines, this Thomas product takes the punishment easily. The heavy, uniform coating of zinc remains undamaged, giving the brushes long life.



Tin Coated Strip—International Register Co. of Chicago, producer of electrical timing devices, made approximately a 20 percent saving when it switched to Thomas pre-coated strip. Tin coated strip, like that above, provides corrosion resistance to dials, gear case covers and other timer parts. Above, Ray Gabriel, International's Steel Buyer, shows Pittsburgh Steel representative Buck Mills a completed Inter-matic Time-All appliance timer.



Lacquered Strip—"Nothing works as well on our machines as lacquered steel strip from Thomas," declares Max Haas, plant manager for Hinton Associates, Inc., of Staten Island, N. Y., manufacturer of Happiness Bird Cages. Hinton Associates processes blue or pink lacquered strip in the machine shown above to form a border for seed guards on its cages. Mr. Haas said: "We like Thomas lacquered strip because it doesn't break in forming machines or power presses. The zinc backing on the strip permits the rolls to get a good grip when the metal passes through our machines."



High Carbon—Thomas Strip's high carbon strip gets a tough test in the Toledo, Ohio, plant of Prestole Corp., manufacturers of steel fasteners. Prestole bends, twists, shears, punches and forms Thomas Strip's high carbon strip, as in the operation above. It has to have steel that's free of excessive burring, gives the finished fasteners the right springback and proper tension. Each coil must be uniform in chemical and physical specifications. "We've never had a complaint yet about Thomas quality," says Roy Gutzmer, plant manager.

Thomas Strip®
Division
Pittsburgh Steel Company
Grant Building • Pittsburgh 30, Pa.

District Sales Offices:

Atlanta
Chicago
Cleveland

Columbus
Dallas
Dayton

Detroit
Houston
Los Angeles

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Warren, Ohio



Now one man can **PUSH-BUTTON-OPERATE** one or several Dempster-Balesters!

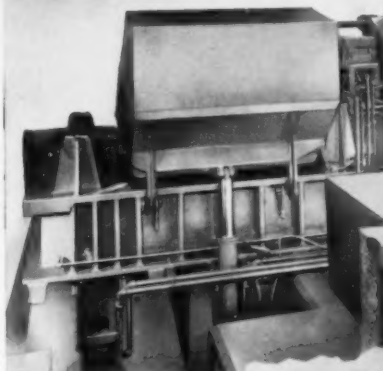


ONE PRESS may be the Dempster-Balester Model 129. Another the Model 351. Another the Model 701, etc. Each may be the same model, or there may be several of one model, one of another. In addition, one or all may be fully equipped with exclusive Dempster-Balester Auxiliary-Compression Door that enables you to bale in a 1-2-3 continuous cycle. This Auxiliary-Compression Door does not "beat" or "tamp" the scrap. It actually penetrates into the charging box, hydraulically compressing the scrap with a 45-ton force!

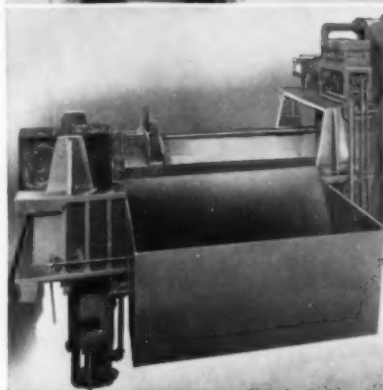
Do you need one Dempster-Balester or several? What model? With or without Auxiliary-Compression Door? With or without push-button control panel? Should your press produce one particular size bale, or be equipped to produce different size bales? Isn't it time we got together? Tremendous savings are yours with the right press, properly engineered and equipped to meet your particular requirements. Ask us to give you complete information. *A product of Dempster Brothers, Inc. Sold in Canada by the W. P. Favorite Co., Ltd., 418 Main Street East, Hamilton, Ontario.*



1



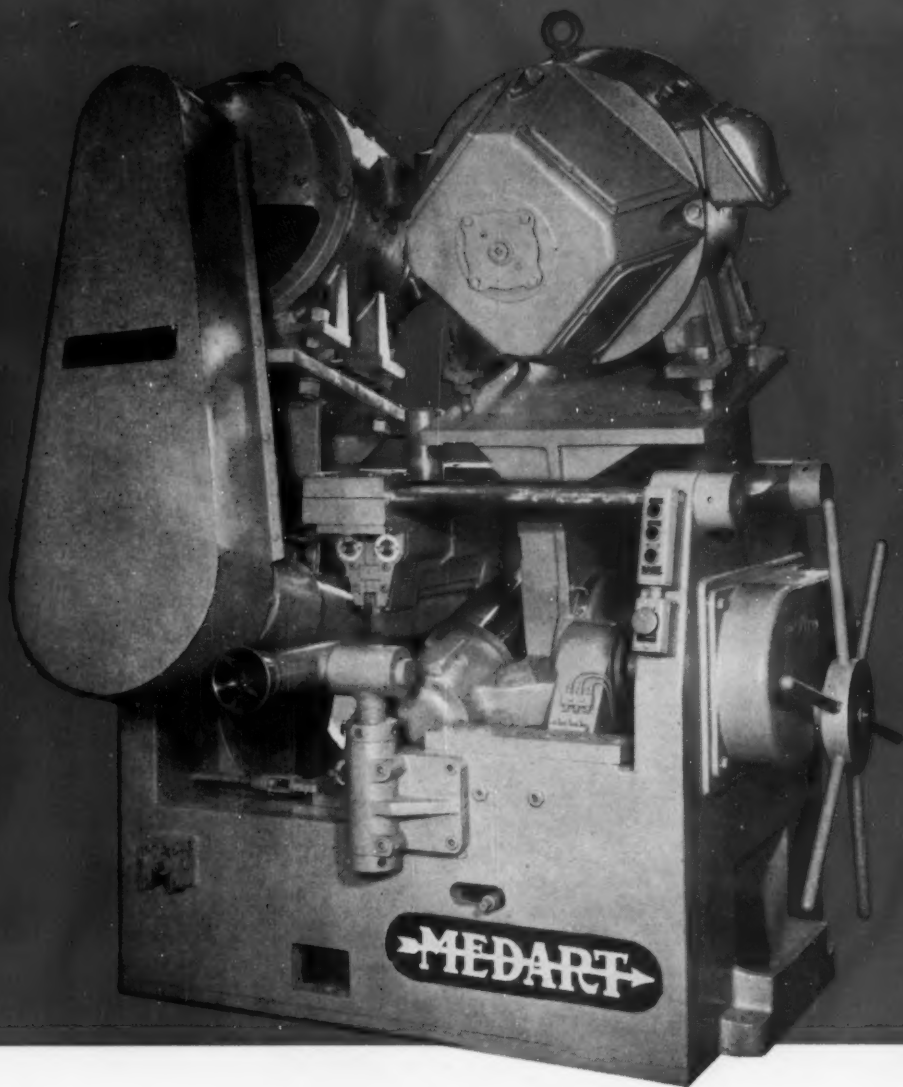
2



3

Photo 1 shows push-button controlled Skip Pan loaded. Photo 2 shows it dumping scrap metal into charging box. When Skip Pan returns to be re-loaded, Charging Box Door moves out, pushing last bale forward, clear of charging box (see Photo 3). Bale ejector returns to lowered position. Pusher heads (rams) proceed to bale the scrap and then automatically retract. Charging Box Door opens, bale is ejected and Skip Pan, which has been re-loaded, is ready to dump another load into box for baling.

DEMPSTER BROTHERS, 466 N. Knox, Knoxville 17, Tennessee



BLAW-KNOX MEDART makes what it takes
for high speed straightening of cold finished stock

Designed around the principle used in the famous Blaw-Knox Medart 2 roll Rotary Straightener, the 2 & 2 Universal Straightener is especially adapted for high speed applications. It is widely used in a direct production line with a draw bench for high speed straightening of cold drawn bars.

In this machine, each roll is driven by its own motor through a completely enclosed V-Belt

drive. This simplified arrangement keeps downtime and drive maintenance to a minimum. What's more it provides for control of throughput rates by varying the speed of the motors. Roll speeds are synchronized by means of electrical interlocks between the motors.

Space requirements are kept to a minimum through compact design and the small number of

working parts. This compact set-up simplifies discharge of work from the machine, making it ideally suited to shorter length workpieces.

The Blaw-Knox Medart 2 & 2 Universal Rotary Straightener and Polisher is available in sizes to handle bars and tubes in diameters of $\frac{1}{8}$ " to $4\frac{1}{2}$ ". Contact us for detailed information, technical assistance or service.



BLAW-KNOX COMPANY

Foundry & Mill Machinery Division

Blaw-Knox Building • 300 Sixth Avenue
 Pittsburgh 22, Pennsylvania





EXPERIENCED WORKMEN are the foundation for continuing skillful and efficient production. At our Bolt and Chain Division, even the most modern equipment is constantly checked by seasoned operators to be sure of uniform top quality in each fastener, regardless of type or size.



REPUBLIC



World's Widest Range of Standard Steels

The case for
FASTENER SELECTION

A century of experience underwrites fastener reliability

What puts the "know" in "know-how"?

The answer is experience . . . a major factor in spelling the difference between ordinary and top-quality fasteners.

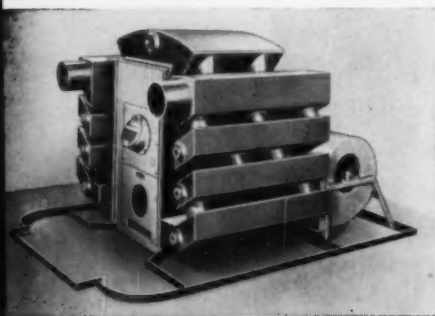
Almost any manufacturer can take a metal bar, upset a head on it, thread the other end and call it a bolt. And it's equally easy to take a small length of square or hex stock, drill it, tap it and call it a nut. But the results, in either case, are far from satisfactory from a production line standpoint.

To satisfy modern industry's demands for practical, uniform, dependable fasteners for every application, it takes the best materials, the best machinery and the best methods. And you get all of these elements when you

specify Republic Bolts and Nuts.

Republic's Bolt and Chain Division is backed by 101 years of experience in manufacturing fine fasteners. As a result, we know the proper analysis of steel for any given application—we know *why* it is best—and we make it to exact specifications in our own mills. This same experience has guided us in establishing the world's finest facilities and methods to assure you uniform high quality in each fastener, in any quantity, every time.

So back your assemblies with the quality fasteners they deserve. Don't just order bolts and nuts . . . *select* Republic and be sure of the best. You can choose from 20,000 standard types and sizes plus 8,000 specials. Mail the coupon today for complete information.



EXPERIENCE MEANS QUALITY in Republic ELECTRUNITE® Mechanical Tubing. That's why The Bard Manufacturing Company, builders of this year-round furnace and air-conditioning unit, says, "ELECTRUNITE Tubing enables us to secure safe, tight gas joints required by our down-flow construction." Republic's Steel and Tubes Division has over 50 years' experience in producing welded tubing suitable for the most exacting requirements.



EXPERIENCE MEANS EFFICIENCY in materials handling equipment. As a major producer of corrugated steel boxes, skids and pallets, our Pressed Steel Division offers all types and sizes to meet normal requirements. And, where you have unusual problems, like the handling of loose tubular parts shown above, we can produce special types to provide years of economical service. Send coupon for details.



EXPERIENCE PROVES DURABILITY of Republic Galvannealed Sheets in outdoor applications, even when only one side is painted. Hot dip galvanizing plus special furnace treatment gives Galvannealed its weather-resistant qualities plus a surface exceptionally well suited to take and hold paint. Forming operations fail to damage these outstanding surface characteristics. Flaking or peeling is practically eliminated.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION

Dept. C-1956

3104 East 45th Street, Cleveland 27, Ohio

Please send me further information on:

- ☐ Bolts and Nuts ☐ ELECTRUNITE Mechanical Tubing
☐ Materials Handling Equipment ☐ Galvannealed Sheets

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____



THE RIGHT SLANT. Her fashionable hat keeps its perky tilt, thanks to CF&I-Wickwire Hat Wire in the brim.



"NEITHER SNOW..." When the going's rough, drivers are thankful for tough, strong tire chains made of CF&I-Wickwire Chain Wire.

*from holding smart hats in shape...
to holding cars and trucks on snowy roads,
nothing does the job like wire!*

The dramatic variety of jobs that wire can fill—almost infinite in number—is encountered every day in hundreds of diversified industries. Shown here are only a few of the countless uses to which wire can be put.

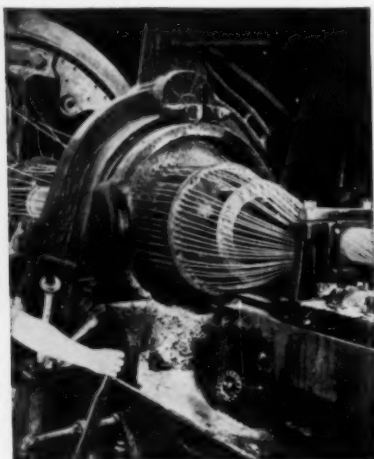
Wire, hair-thin to rod-thick, can be supplied with properties engineered to meet practically any need you may have for it. And CF&I-Wickwire Wire, with a century and a quarter of experience behind it, is ready to serve

you by answering all your wire requirements.

Whatever you assemble, manufacture, or process, check into all the advantages you would gain by using CF&I-Wickwire Wire. You'll like doing business with CF&I-WICKWIRE, and the careful attention given your own particular requirements.

CF&I-Wickwire Wire is made in plants conveniently located from coast to coast. For detailed information, write our nearest district sales office.

ALL WOUND UP. Here a submarine cable is being sheathed in CF&I-Wickwire Armor Wire for protection and resistance to mechanical failure.



DROPPING A MOUNTAIN with dynamite is accomplished with CF&I-Wickwire Fuse Wire for detonators.



SPEEDING AMERICA'S RECORD HOUSING PROGRAM. Stapling insulation to walls saves days of construction time and cuts building costs. CF&I-Wickwire Stapling Wire is used for all kinds and sizes of staples.



IT'S CHILD'S PLAY to open today's sardine tins. Their sturdy key openers are made of CF&I-Wickwire Can Key Wire.

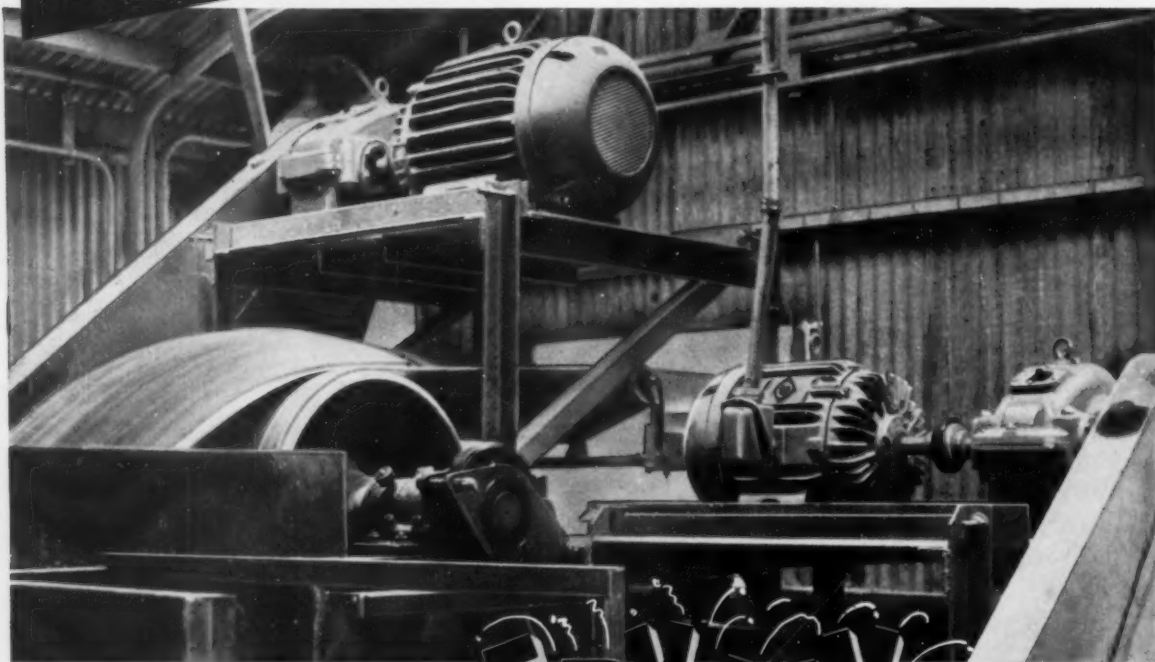
CF&I-WICKWIRE WIRE

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
El Paso • Ft. Worth • Houston • Lincoln (Neb.) • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
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WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia



There's
MORE

Cooling Surface in these deep-ribbed **MOTORS**



No Day is

FRY DAY



with these **Allis-Chalmers**

MOTORS

● Frying of insulation is impossible under normal conditions with the extra-large cooling surface of Allis-Chalmers rib-type TEFC motors. The result—you expect and get longer motor life.



The engineered partner of A-C motors is Allis-Chalmers control.

Get Complete Information

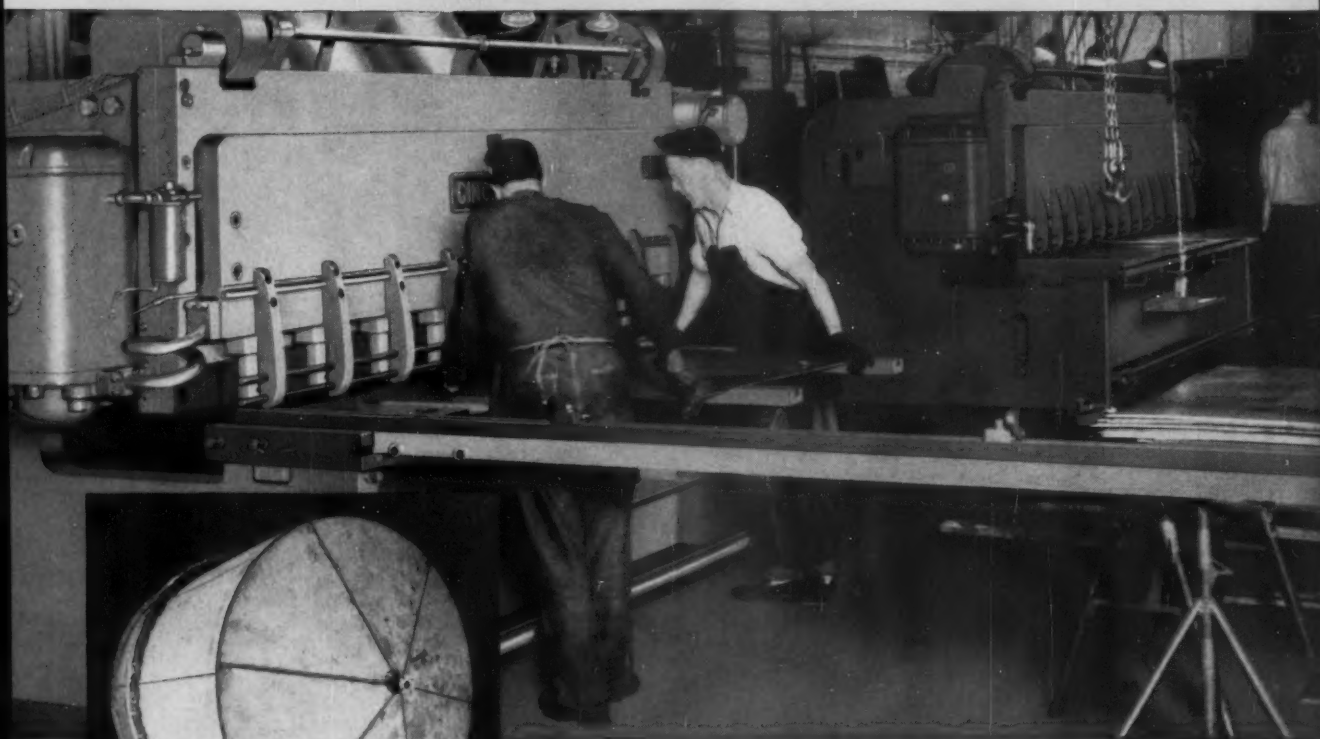
As a new machinery component or as replacement, specify Allis-Chalmers. Discuss your particular application with your nearby A-C distributor, A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS



A-4920

They handle the job faster with
CINCINNATI Shears
at LITTLEFORDS...



Photos courtesy the Littleford Bros., Inc., Cincinnati, Ohio.

Shearing stainless steel for tanks in the Littleford Shops.

"Faster handling—with a high degree of accuracy", say Littleford Bros.

Simple, rapid and positive gauging, with the accurate shearing performance of these Cincinnati Shears—gives a clean cut, economical production, with long knife life and low maintenance.

Write for Shear Catalog S-7

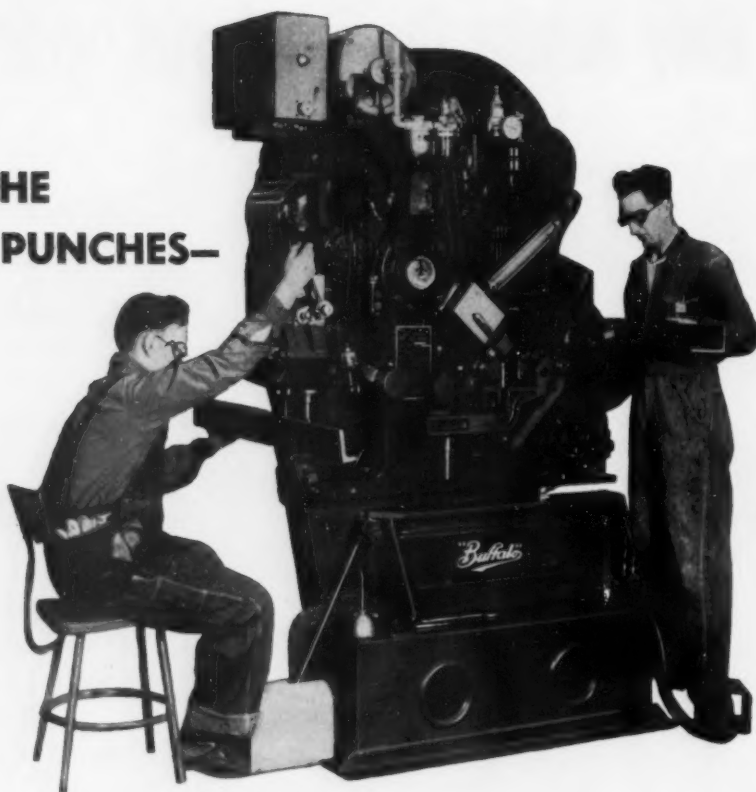


THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A.

SHAPERS • SHEARS • BRAKES

**HE
PUNCHES—**



**—WHILE
HE
COPES**

—JUST A SMALL SAMPLE OF THE USEFULNESS OF THE "BUFFALO" UNIVERSAL IRON WORKER

1. NOTCHES The only machine available with built-in V-notcher—*independent of other operations.*

2. SHEARS - SLITS Has handy crank-adjusted stripper and broad shelf for adequate support of work.

3. PUNCHES Angles, flats, channels, tees, beams (in flange or web). Floating punch head permits accurate spotting of work.

4. MITERS ANGLES square, 45°, 30° and 15° with quick pin-in-hole setting for angle of cut

5. CUTS BARS square or round. Stripper always rigidly fixed in position.

6. COPES The only machine available with built-in square coper, *independent of other operations.*
SIZES TO HANDLE THE WORK YOU DO!

Write for Bulletin 360 for all details on these versatile, quality-built machines to speed up your maintenance and production fabrication.



BUFFALO FORGE COMPANY

492 BROADWAY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING



PUNCHING



SHEARING



BENDING





*Our
challenge
stands*



*- anything that can
be made of steel sheets can be made of*

Believe it or not, this galvanized recessed ceiling light reflector housing was made by spinning. "Impossible," you say? "Can't be done with ordinary galvanized steel?"

You are right! It *isn't* made of ordinary galvanized steel.

It's made of Wheeling **sofTITE**, the tightest-coated galvanized sheet yet produced. So tight it won't chip, crack, flake or peel no matter how severely it is formed. It even takes *spinning* in its stride. In fact, *anything* that can be made of steel sheets can be made of Wheeling **sofTITE**.

That's **sofTITE**... made by the same company that developed Cop-R-Loy, the original copper-bearing steel pipe... and **DUCTILLITE**, the original cold reduced tin plate. Now **sofTITE**, the ultimate in ductile, tight-coated galvanized steel sheets... a product of Wheeling Steel Corporation, Wheeling, West Virginia.

WHEELING

sofTITE[®]

Galvanized Sheets



IT'S WHEELING STEEL

District Offices — Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco

June 28, 1956

25



ALL STEELWELD SHEARS CONTROLLED ELECTRICALLY...

OPERATION of Steelweld Shears is unusually easy and convenient. There is no tiresome lifting of the leg to work a foot treadle. Slow, fatiguing knee action has been replaced by fast easy toe action.

A safety type electric foot switch is used. It can be slid around the floor wherever most convenient. It enables shearing speeds not attainable with foot treadles for certain cutting operations.

For instance, when cutting narrow strips from a long sheet, the operator can push the sheet at the end

and control the shear at the same time. He need not be near the machine. As the sheet becomes shorter he can move the switch along with his foot to always be within easy reach.

There is no extra charge for electrical foot control on Steelweld Shears—it is standard equipment on all size machines.

Steelweld Shears are radically different from all other shears with many outstanding features. Get the facts on these truly new and modern machines. Learn about the advantages they offer you.



GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

4803 EAST 282nd STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS



DIMENSIONAL ACCURACY...

obtained by Cooper Alloy

through SHELL MOLDING with G-E Shell Molding Resins

This stainless steel instrument housing, cast for a customer by Cooper Alloy Corporation, Hillside, N. J., was one of those "impossible" jobs. Previous experience by the customer had resulted in shrink defects in the lugs on the open face, rendering the castings unacceptable. The job was further complicated by the fact that dimensions and finish were equally critical on both exterior and interior surfaces.

Through shell molding and advanced foundry techniques, Cooper Alloy was able to convert this "impossible" job to a standard production run! Hollow shell cores achieved the required accuracy and finish for the casting's interior; the Shellcast* process accomplished similar results for the exterior. G-E shell molding resins helped Cooper Alloy obtain close dimensional accuracy, fine finish and uniform soundness.

How can shell molding help YOU?

Cooper Alloy uses General Electric shell molding resins in its Shellcast process, relying on them for batch-to-batch uniformity and correctly balanced properties. Other G-E products for shell molding include: G-E silicone release agents to release molds easily from patterns and G-E phenolic bonding resin to assemble shell halves together.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

Ask G. E. about shell molding!

General Electric maintains a shell molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process. G.E. also offers a 28-page manual describing the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*

*Reg. trademark, Cooper Alloy Corporation

FREE SHELL MOLDING MANUAL!

General Electric Company
Section 6F4D1
Chemical and Metallurgical Division
Pittsfield, Massachusetts



Please send me a free copy of G-E Shell Molding Manual.

- ☐ We are presently using the shell molding process.
☐ We are interested in the shell molding process.

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Firm

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City Zone State

Wagner®
CRANE-BRIDGE BRAKES
...the choice of leaders
in industry

131 CRANES at Aliquippa... all equipped with **Wagner**

Hydraulic Crane Brakes

There are 131 overhead traveling cranes in operation at Jones & Laughlin's Aliquippa Works and *all* of them are equipped with Wagner Hydraulic Crane Bridge Brakes.

This is because J&L is interested in safety, economy, and ease of crane brake operation. J&L has found that Wagner crane bridge brakes rank high in these three considerations.

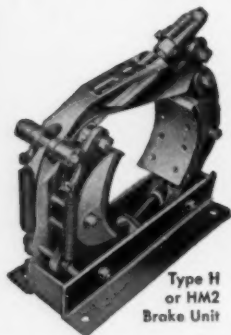
The 75-ton Bessemer crane shown here is equipped with Wagner *Powered* Hydraulic Crane Bridge Brakes. These brakes are:

SAFE because cranes can be controlled without bridge motor plugging which causes damage to both motor and gears. Parking brakes can be set automatically in case of power failure.

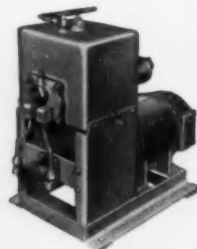
ECONOMICAL because operators are less likely to drag *powered* brakes. There's less wear on wheels and lining... life of equipment is prolonged. Several brakes can be operated from one pedal so it's easy to step up production.

EASY-TO-OPERATE... tip-toe braking... finger-tip parking... one-minute bleeding.

Wagner power units can be added to your present Wagner Hydraulic System. Only six weeks are required to fill the average order. Bulletin IU-36 gives full details—write for your copy today.



Type H
or HM2
Brake Unit



Hydraulic power unit
driven by totally-
enclosed motor



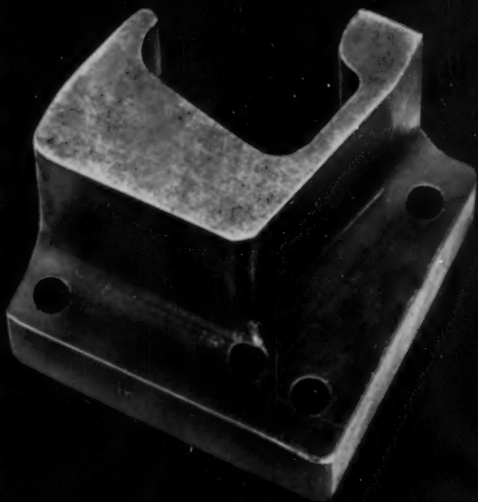
WAGNER ELECTRIC CORPORATION
6403 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE
BRAKE SYSTEMS—
AIR AND HYDRAULIC

195-3

FIELD REPORT: NO. 90



WHICH DIE STEEL WOULD YOU USE HERE to get this punch out of hardening in one piece?

This punch blanks automotive stampings from SAE 1010 strip, .062" thick. It is so unbalanced in design that safety in hardening is vital in the die steel used. Since the punch is shear fitted to the die section before heat treating, accuracy in hardening is equally important. The punch is hardened to Rockwell C-61/62. All the steels tried either broke or changed size excessively.

If the decision were squarely in your lap, which die steel would you be willing to recommend?

Here's how the manufacturer solved the problem, as recorded in a Field Report from our customer: The Carpenter Matched Set Method showed that Carpenter VEGA (Air-Tough) Die Steel had the hardening safety and accuracy plus toughness demanded by the job. The punches are now coming through heat treatment "right on the nose," and production between grinds has jumped from about 10,000 to 50,000 parts. Further, the heat treater says VEGA is the easiest air-hardening steel he has ever worked with.

When the decision is up to you, rely on Carpenter for dependable results. For fast attention to your orders, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor, today.

Your toolroom can use Carpenter Matched Tool and Die Steels to:



- Reduce hardening hazards
- Minimize machine downtime
- Boost output per grind
- Improve product quality

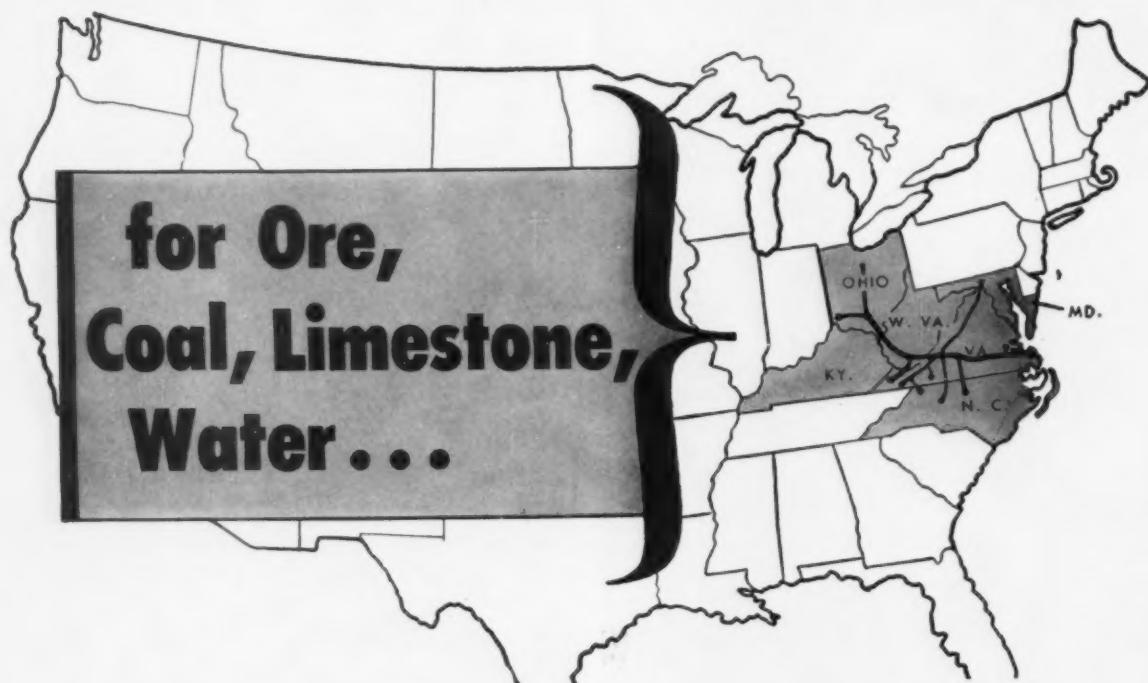
Carpenter STEEL

Matched Tool and Die Steels



IMMEDIATE DELIVERY from local warehouse stocks—The Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Export Address: Port Washington, N. Y.—"CARSTEELCO"

Attention Steel Executives



along the Norfolk and Western is the plant site for you!

You can build a steel mill along the N&W and be "next door" to coal and limestone. You can build directly alongside the water you need. You can avail yourself of short-haul advantages in transporting ore from the big, modern Port of Norfolk.

The coal is the world's finest Bituminous, and the supply is virtually unlimited.

The limestone is top-grade . . . dolomites and high-calcium . . . the largest sources east of the Mississippi.

The water is adequate for the needs of a steel mill of any logically conceivable size.

We have eye-opening data on exceptional location advantages for steel mills. **WE INVITE YOU TO CONFIRM OUR FINDINGS.** Our plant location specialists will work with you in confidence and without obligation.

The advantages outlined are exceptional. Investigate them.

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Norfolk and Western Railway

Engineering in Action

... BACKED UP

three deep

with parts and service—when you use

Allis-Chalmers FORK TRUCKS



Strategically located FACTORY



You enjoy almost "Factory-town" service wherever you are when you operate Allis-Chalmers Fork Trucks—for you are backed up *three deep* by Allis-Chalmers' highly successful dealer-branch-factory system.

What does this mean? It means that your dealer is serviced directly from a nearby factory branch—one of 14. Each branch carries a full stock of True Original Parts and is staffed with factory-trained servicemen as well as sales engineers. This assures prompt attention whether you need a replacement part or technical advice.

Ask your Allis-Chalmers material handling dealer to show you how Engineering in Action with this *three-deep* service can help on your specific job. Write for literature and details.

MATERIAL HANDLING DEPT., BUDA DIVISION, MILWAUKEE 1, WISCONSIN



Your nearby DEALER

ALLIS-CHALMERS





Wyman-Gordon fuselage frame forging ready for quality inspection with Immerscope. Wyman-Gordon chooses the Curtiss-Wright test system to assure highest quality for parts which must later meet extreme stresses in fighter aircraft.

CURTISS-WRIGHT IMMERSCOPE PROVES SOUNDNESS OF FORGINGS BEFORE SHIPMENT FOR WYMAN-GORDON



New Curtiss-Wright Immerscope (Model 424-A) protects quality of forgings, rolled plate, welded tubing, extrusions and other metal products. Complete with controls for gate width and depth, alarm trigger, and sensitivity time control. 400 w, 110-120 v, 60 cycle. 16"x15"x21½". Operates at 2.25, 5, 10, 15 and 25 megacycles.

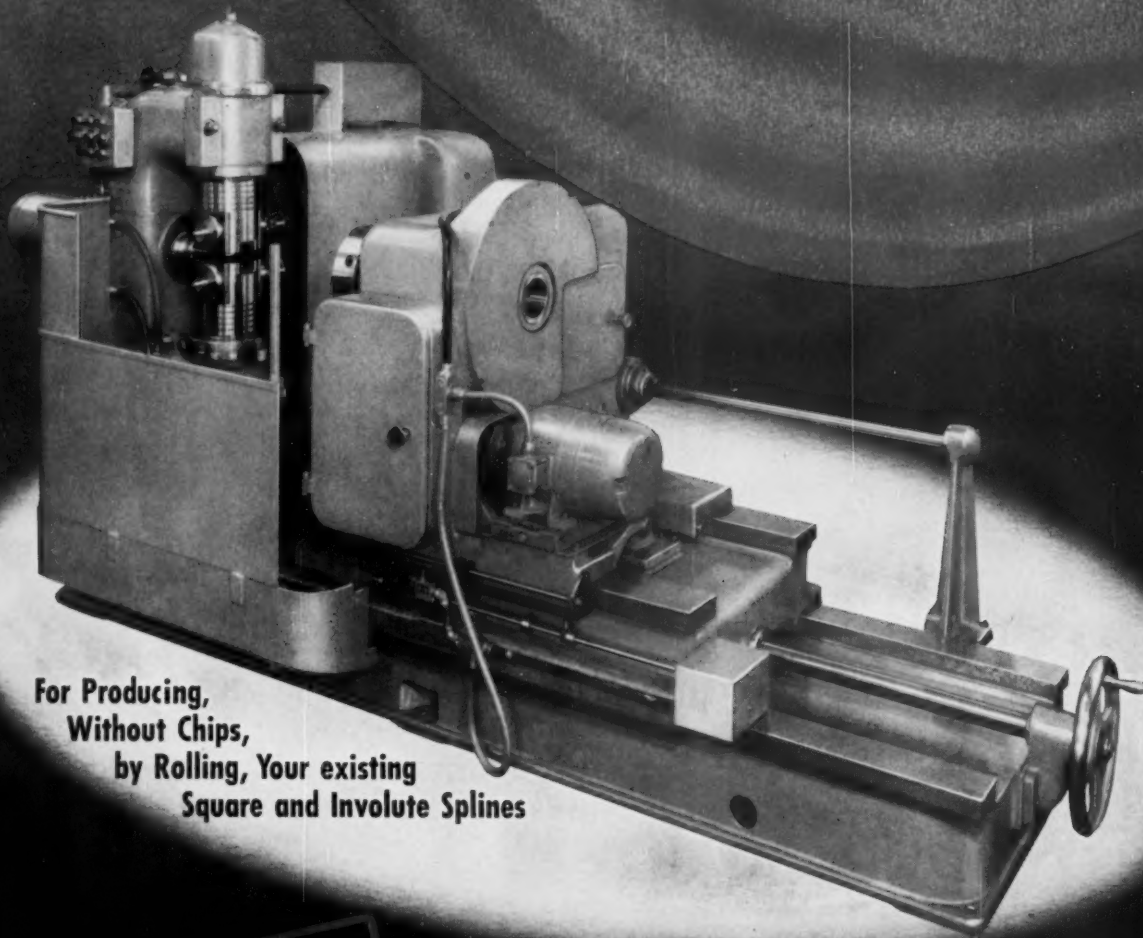
Non-destructive, ultrasonic test equipment guards your reputation for quality

An ultrasonic "search crystal" passed back and forth over a forging immersed in water "sees" through the metal, using electrical vibrations of up to several million cycles a second. Internal flaws are shown as "pips" — visible readings reported on the cathode ray of the precision Curtiss-Wright Immerscope. This ultrasonic detective sounds out variations from metal specifications . . . provides for thorough inspection before or after machining. Production is speeded, costs lowered. Customers receive quality controlled shipments every time.

Put ultrasonics to work for you. Write for full details and engineering assistance to Industrial and Scientific Products Division, Curtiss-Wright, P.O. Box 270, Caldwell, N.J.



Raising The Curtain On The LEES-BRADNER Manufactured, GROB PROCESS, **SPLINE ROLLING MACHINE**



For Producing,
Without Chips,
by Rolling, Your existing
Square and Involute Splines

REVOLUTIONARY

CHIPLESS

ACCURATE

FAST

ECONOMICAL

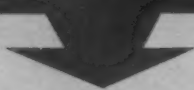
See reverse side for
specifications and
features

the **LEES-BRADNER**

CLEVELAND 11, OHIO • U.S.A.

Company

Here's Why True Rolling Is Better



No need to redesign—use your existing profiles.

Your existing splined profiles produced in $\frac{1}{3}$ present hobbing times.

Forming roll costs about $\frac{1}{9}$ of hob costs—"resharpening" costs eliminated!

No chips.

Manual loading or automatic self-loading and self-unloading, as you prefer.

Splines precision produced with amazing improvement in finish.

SPECIFICATIONS

Capacities

Root Diameter of work Max. 4" Min. $\frac{3}{4}$ "

Between centers Max. 48"

Length of Spline Max. 9"

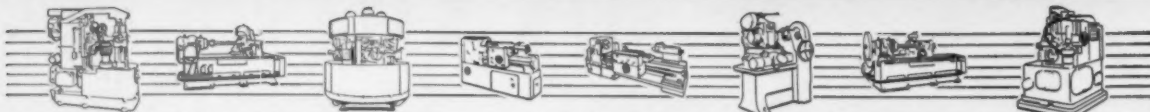
Diameter of hole through work holding spindle 6"

Work Spindle Speeds—1800 RPM divided by the number of teeth in the work

Motors—Main Motor 10 HP. Rapid Traverse Motor 5 HP.
Rev. Feed Motor 5 HP. Pump Motor $\frac{1}{2}$ HP.

Length 14 ft. Width 6'6" Height 6'0"

Weight (net) 15,000 lbs.



IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

Eriez Permanent Magnets to SEPARATE... RETRIEVE... PURIFY

SOLVE HUNDREDS OF METAL- WORKING PRODUCTION PROBLEMS

Famous for years as magnetic separators to remove tramp iron from processing lines of all types, Eriez Permanent-Powered Magnets have recently found widespread acceptance in the metalworking industry, where they are used to separate, retrieve and purify. In addition, Eriez HI-POWR Magnets especially designed for controlling and conveying purposes, move steel horizontally, vertically or up steep inclines at such speeds as to allow peak production. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Their magnetic power is guaranteed forever. The first cost is the last.* Eriez also recently introduced its new line of HI-VI Electro Permanent Magnetic Vibratory Equipment, consisting of Vibratory Feeders and Unit (Bin) Vibrators. The heart of this unique equipment is a permanently powered Alnico V magnetic element which eliminates rectifiers... produces a 2-way push-pull action for more productive performance... provides broader operating ranges with less power consumption. HI-VI units are lightweight, easily installed, never need realigning, have no friction-producing parts to wear, need no lubricants. Write for complete details.



OLD IRON PANTS AND THE MAGNET. A lady from yesterday with a metal-ribbed girdle wouldn't be safe next to an Eriez Permanent Non-electric Magnet. She might easily be "hung up" by the powerful Alnico V action. This idea of herculean power and permanent dependability now offers the metalworking industry many new ideas for separation, purification, and retrieving of ferrous material from places where it would cause machinery damage or product defects. In addition, Eriez Magnets designed to control and convey metals at high speeds have presented new concepts in plant automation.

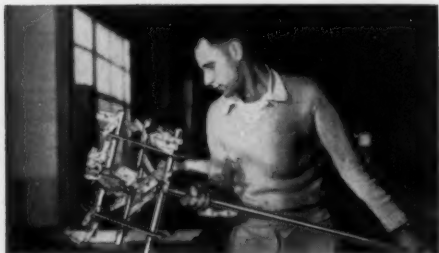


ERIEZ SHEET FANNER MAGNETS. Here's the magnet to speed up sheet metal handling and increase production. Slow, costly hand separation is completely eliminated... no more double feeding, no scratched surfaces, no cut fingers. An Eriez Sheet Fanner Magnet placed next to a pile of sheet metal *automatically* lifts the top sheet into the air, allows fast, safe removal. When this sheet is removed, the following one automatically rises. Ideal for irregular, odd-shaped sheets. Available in five strengths.

MAGNETIC IDEAS FROM



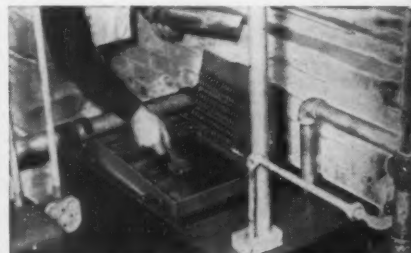
ERIEZ



ERIEZ DIP TANK MAGNETS. Here's a handy piece of magnetic equipment designed for fast, sure removal of ferrous materials from tanks, etc. Powerful, permanent magnetic bar element will snap up and hold liberal amounts of metal parts, fine iron particles, etc., from dip tanks, plating tanks, hydraulic system oil reservoirs, acid baths, vapor degreasers, heated ovens, etc. Runners make it exceptionally easy to maneuver on tank bottoms. Standard models are all-stainless steel construction with handle length up to 8 feet. Approximate weight: 16 pounds.



ERIEZ MAGNETIC AGITATOR DRUMS. Here's the unit designed to eliminate slow, costly separation of magnetic from non-magnetic materials. Easily installed at the discharge end of spouts, screw conveyors, gravity flow chutes, etc., the powerful action of the drum's specially located Alnico V elements automatically separates the material as fast as it is fed to the drum. Ideal installation for sand blast reclamation, chip material separation, and wherever there is a high concentration of medium sized ferrous material.



ERIEZ MAGNETIC FERROUS CLEANER. Designed to magnetically remove fine iron contamination from liquids, the Eriez Ferrous Cleaner is a lightweight, portable non-electric separator that can be placed at more than one convenient place in a processing line. Thin flows of powder can also be cleaned of iron if the unit is used in conjunction with a vibrating feeder. Adjustable gate controls the rate of feed onto the chute and magnetic grid. Removable grid with 124 magnetic fingers is easily cleaned. Effectively prevents rust spots and product spoilage.

Eriez "Magnetic Ideas" can help you. Eriez factory-trained field men, backed by extensive laboratory and engineering know-how, will be happy to study your particular metal handling problem and offer helpful "Magnetic Ideas". Our representatives are always glad to work with your engineering department or consulting engineers on any problem, large or small. For additional information concerning magnetic problems in the metalworking industry, write for new bulletin B-207. Address Eriez Manufacturing Company, 100F Magnet Drive, Erie, Pennsylvania.

How Transit Cranes PAY OFF on Material Handling Jobs



You don't have to look far to see why Bucyrus-Erie Transit Cranes are superior machines for material handling jobs. Both the 15-ton model 15-B and the 25-ton model 22-B give you more of the features you need most for efficient operation. Many of these are available on other cranes only as "extra" equipment . . . but all are standard on Bucyrus-Erie Transit Cranes. Here are just a few of them:

- Friction swing brake — permits operator to spot and hold boom point over desired position.
- Power controlled lowering for main hoist line on lifting crane — provides high accuracy in lowering loads.
- Independent power boom hoist with power controlled lowering — allows boom angle to be changed while machine is swinging, while load is being hoisted or lowered.
- Open throat boom design — permits rigging 2, 3, or 4 parts of line without fouling boom even at high angles.
- 8-part pendant suspension — ideal for changing boom lengths conveniently and with minimum downtime.

- Safety boom stops on all machines equipped for lifting crane service — provides added safety by preventing boom from accidentally snapping over center and striking cab.
- Boom angle indicator — enables operator to determine angle of boom at all times.
- Extendible outriggers, two on each side of carrier chassis — provide added stability for swinging capacity loads.
- Full 3-side vision from operator's cab — gives operator clear view of his entire operating range and of all men or obstructions in the vicinity.

Your nearby Bucyrus-Erie distributor has more information on these moneymakers. See him soon and find out which size fits your requirements. You'll be mighty glad you did.

256E56

**BUCYRUS
ERIE**

South Milwaukee, Wisconsin

THE IRON AGE



Size is relative . . .

but these stainless steel heads
are big and heavy gauge in
anyone's eyes.

They are typical, too,
of the unusual in
Carlson service.

***When you want stainless
steel plates,
plate products, forgings, bars,
and sheets (No. 1 Finish)***

***come to your headquarters
for service***

Stainless Steels Exclusively
C. C. CARLSON, INC.

THORNDALE, PENNSYLVANIA

District Sales Offices in Principal Cities

These four semi-elliptical
heads are made of Type
304 stainless steel. Out-
side diameter: 74 $\frac{3}{4}$ ".
Gauge: 2.58" minimum.
Weight: Each head
weighs over 3 tons.



**Republic Alloy
Steels provide
safety...
dependability
...long life in
hand tools**

REPUBLIC



World's Widest Range of Standard Steels

To maintain today's peak production schedules, workmen's hand tools used for assembly, maintenance or repair of equipment must be of high quality. They must be safe and dependable to meet the increased emphasis on the elimination of lost time accidents. They must have long life because production shops keep accurate records on the hourly life of these tools and insist on the ones that last the longest.

Republic Alloy Steels provide tool manufacturers with a combination of qualities essential in the production of socket wrenches, box and open end wrenches, speed handles and screw drivers.

Alloy steels offer a greater degree of safety than other materials because they can be tempered to a greater depth. They can also be heat treated at higher temperatures. Their response to heat treatment is such that uniform structures can be formed in tools where the section mass changes abruptly, as in box wrenches. Higher draw temperatures and greater depth of penetration make a tool that is tougher, able to stand up in severe service.

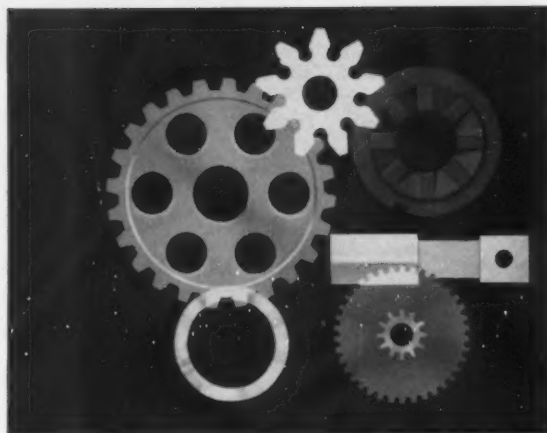
One additional requirement of the modern hand tool is that it be strong, yet easy to handle. Here again alloy steels fit the bill. Their high strength-to-weight ratio permits the use of thinner sections to hold down size and save weight—without any sacrifice of needed strength.

Now, what about your product? Republic metallurgists and engineers are ready to give you obligation-free assistance in the application of these fine steels to your product—assistance that can insure safety, extend equipment life, reduce maintenance and replacement costs. Mail the coupon today.

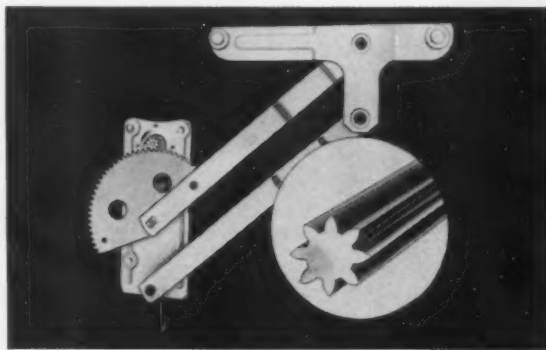
The tools shown at left were made from Republic 4140 Hot Rolled Alloy Steel Bars by The Cornwell Quality Tools Company, Mogadore, Ohio. This manufacturer has used alloy steels for more than 30 years.

STEEL

and Steel Products



REPUBLIC IRON POWDER OFFERS YOU NEW PROFIT OPPORTUNITIES IN SMALL PARTS PRODUCTION. Parts can often be made faster, more uniform and at less cost using Republic Iron Powder. It is also being used successfully in making complicated shapes which are difficult to produce economically by other means. Republic metallurgists and engineers, with a thorough knowledge of all types of metals, can help you determine iron powder's suitability to your parts production. Or, they can suggest alternate methods or materials better suited to your particular needs. This service is available without cost or obligation. Just mail the coupon.



REPUBLIC COLD DRAWN SPECIAL SECTIONS REDUCE MACHINING ON WINDOW GEAR TO TWO SIMPLE OPERATIONS. The only machining operations required are cutting-off and drilling. The manufacturer uses Republic Cold Drawn Special Sections preformed to the predominating cross section of the gear. Special sections provide almost limitless flexibility in design. They permit replacement of costly assemblies with one-piece shapes. They simplify built-up, interlocking or associated parts. Higher strength, greater hardness and a bright, smooth finish are additional benefits of the cold drawing process. Republic Special Sections are made to specification in all grades of carbon, alloy and stainless steel.

REPUBLIC STEEL CORPORATION
Dept. C-2146
3104 East 45th Street
Cleveland 27, Ohio

Send more information on:

- ☐ Alloy Steels ☐ Iron Powder
☐ Have a metallurgist call. ☐ Special Sections

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Company _____

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**3 more
BIRDSBORO
hydraulic
presses...**



**...being delivered to plants where speed
and flexibility are demanded**

**DESIGNERS
AND BUILDERS
OF:**

**STEEL MILL MACHINERY
HYDRAULIC PRESSES**
(Metalworking and Extrusion)

**CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS**

Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

• The 250-ton Press on the left has been delivered to Continental-Diamond Fibre Co., the center Press will operate at 250-ton capacity for Mica Insulator Company, and the 1500-ton Double Action Press on the right is now increasing production for the Wyman-Gordon Company. What sold these presses? Was it the desire for new production highs, or greater stamping accuracy, or greater production control? Or it might have been the important need for reduced costs made possible by the specialized knowledge and experience of our engineers. Call your BIRDSBORO representative, he'll be able to give you the details of the benefits you seek... and get when you specify BIRDSBORO Presses.

HP-27-56

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., Main Offices in Birdsboro, Pa. District Office: Pittsburgh, Pa.

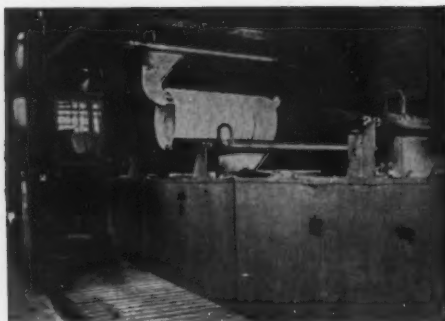
New York Office: Engineering Supervision Co., 120 West 42nd Street, New York 36, N.Y.

NO PICKLING PROBLEM Too Large or Too Small

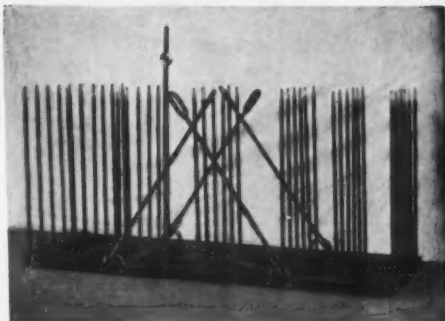
WELDCO Specialists Handle Them All!

IN HUNDREDS OF PLANTS, you'll find Weldco equipment all along the pickling line. For Weldco products are made of corrosion-resisting, hot rolled metals, that withstand attack from hot acids and other pickling solutions. They are strong yet lightweight, wear-resistant, durable, and long-lasting. You get all these advantages when you specify Weldco hooks, mechanical picklers, crates, baskets, racks, chain, steam jets, and accessories.

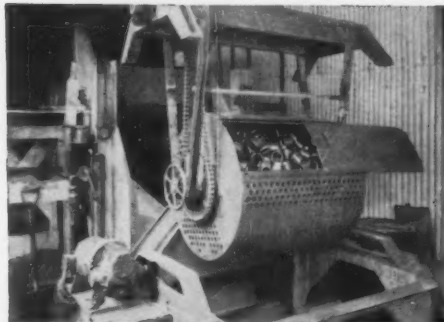
Weldco offers a complete, well-designed line of pickling equipment . . . plus the services of our experienced staff. Let Weldco engineers take care of all your pickling needs. For any problem, large or small, they have the practical, cost-cutting answer.



Weldco Pickling Hooks



Weldco Sheet Pickling Crate



Weldco Mechanical Drum Pickler



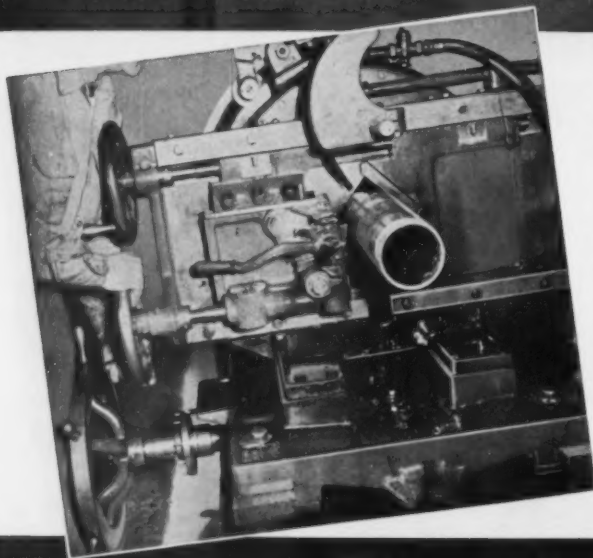
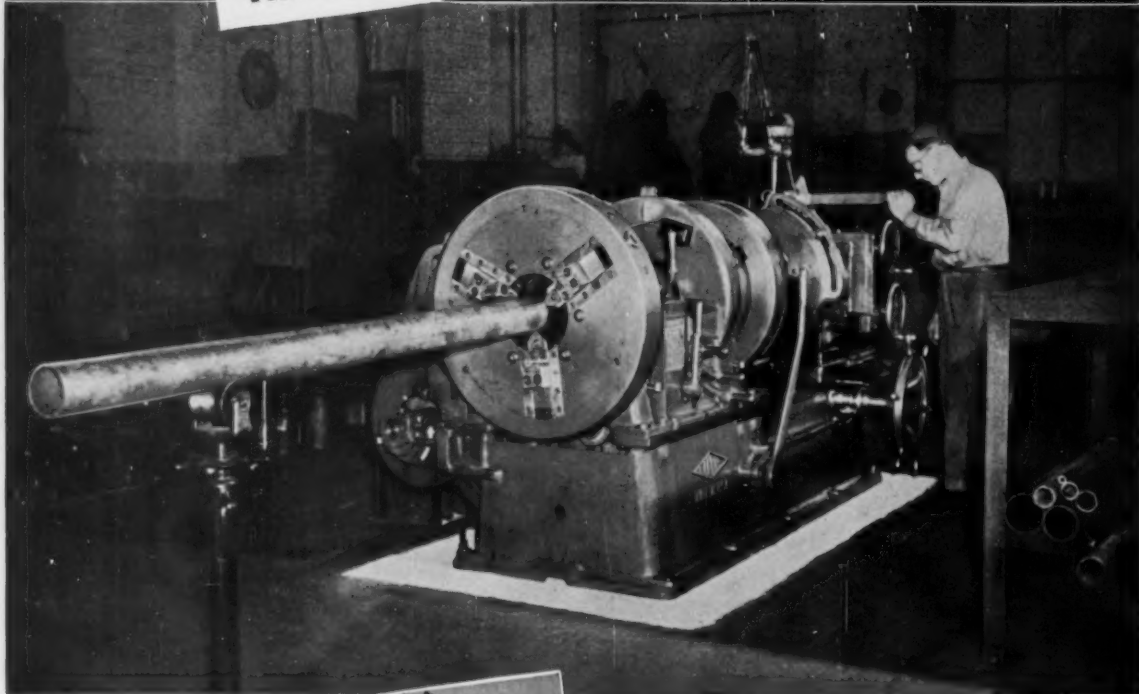
Weldco Metal Chain

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY

3712 OAKWOOD AVE. • YOUNGSTOWN 9, OHIO

VERSATILITY

Saves **TIME & MONEY** *in Maintenance Shops*



Photographs show a Landis Pipe Threading Machine installation in a Job Shop of the New York Central Railroad. This shop, located at Weehawken, New Jersey, operates as a Marine Repair Shop handling maintenance for tugs, barges, lighters, etc. Illustrations show wrought iron pipe being cut off after reaming and threading. Standard pipe threads are cut $1\frac{1}{2}$ " long on the 4" pipe, using a cutting speed of 25 surface feet per minute. This machine is also used for cutting boiler tubes to length.

The wide diametrical range of the die heads and the use of patented tangential pipe chasers gives these machines a versatility invaluable in maintenance work. For example, the 6" Landis Pipe Threading Machine illustrated threads all pipe sizes from 1" to 6", inclusive. Size adjustment of the die head is simple and quick. Chasers need not be changed except for threads of a different pitch, form, or taper. Chasers are interchangeable and need only be replaced singly as needed. Tangential cutting action reduces wear, and chasers can be reground to use over 80% of their length. Write for Bulletin C-61.

LANDIS Machine COMPANY

WAYNESBORO · PENNSYLVANIA · U. S. A.

LOEWY

LOEWY

This 50,000 ton closed die forging press was designed and built by Loewy-Hydropress for the U.S. Air Force heavy press program.

world's largest forging press cuts costs of aircraft parts

In successful operation since October, 1955, at the Wyman-Gordon—U.S. Air Force plant in North Grafton, Massachusetts, this press is producing wing spars and other aircraft components in production quantities and at much lower costs than ever before. One typical example is a forging 10 feet long by 18 inches wide which replaces 62 pieces and 800 rivets required under previous methods of construction.

The most intricate shapes can be formed, with high physical properties in spite of their thin cross sections. Currently set up for alumi-

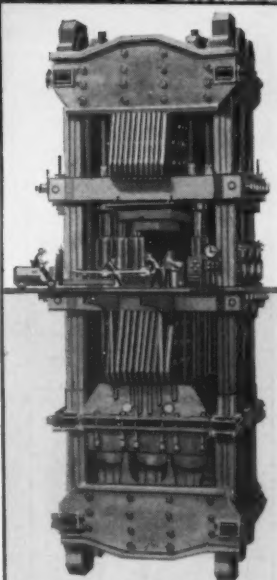
num alloys, the Loewy press is also adaptable for steel and titanium.

If you need forging presses, extrusion presses, rolling mills or accessory equipment of any size or any capacity, small or large, or a complete "turn-key" plant, call in Loewy-Hydropress. For illustrated bulletin L-144, write Dept. 216, Loewy-Hydropress Division, BLH Corporation, 111 Fifth Avenue, New York 3, N.Y.



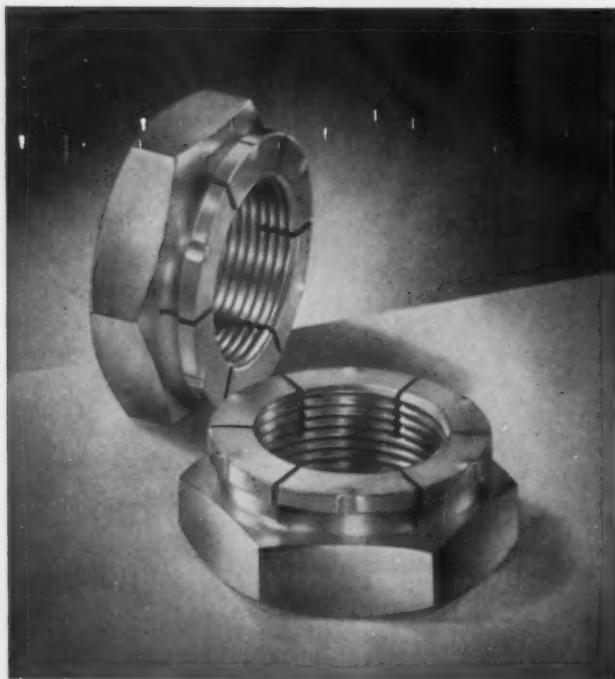
LOEWY-HYDROPRESS BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Hamilton
• Electronics & Instrumentation • Lima • Madsen •
Loewy-Hydropress • Pelton • Standard Steel Works



High as a 10-story building, the huge press is more than half underground. Installed at Wyman-Gordon Co.-U. S. Air Force plant.

Flexloc thin nuts save space, weight and production time



SPECIFICATIONS
FLEXLOC THIN NUTS



NATIONAL COARSE THREAD—U.S.S

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-32	.312	.125	.361	1.8
8-32	.344	.172	.397	2.8
10-24	.375	.172	.433	3.3
1/4-20	.438	.203	.505	5.4
5/16-18	.563	.250	.649	11.6
3/8-16	.625	.265	.722	14.9
7/16-14	.750	.312	.866	24.9
1/2-13	.813	.312	.938	28.4
9/16-12	.875	.359	1.010	36.1
5/8-11	1.000	.391	1.155	54.1
3/4-10	1.125	.406	1.299	69.2
7/8-9	1.312	.469	1.516	107.5
1-8	1.500	.563	1.732	171.6

NATIONAL FINE THREAD—S.A.E.

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-40	.312	.125	.361	1.8
8-36	.344	.172	.397	2.8
10-32	.375	.172	.433	3.3
1/4-28	.438	.203	.505	5.4
5/16-24	.500	.250	.577	8.7
3/8-24	.563	.266	.649	11.5
7/16-20	.625	.312	.722	14.9
1/2-20	.750	.312	.866	21.7
9/16-18	.875	.359	1.010	36.2
5/8-18	.938	.391	1.082	42.4
3/4-16	1.063	.406	1.227	54.5
7/8-14	1.250	.469	1.443	84.6
1-14	1.438	.563	1.660	136.3
1 1/4-12*	1.625	.625	1.876	193.5
1 1/2-12*	1.813	.750	2.093	296.0
1 3/4-12*	2.000	.812	2.309	389.0
2-12*	2.187	.875	2.526	498.0

*Steel only (plain or cadmium plated) in stock sizes.

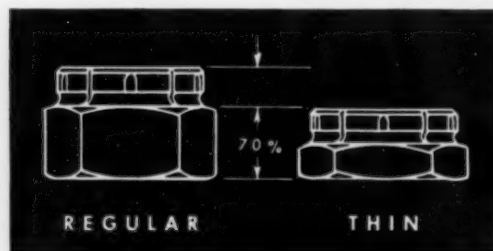
Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools

Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 17, Pa.



FLEXLOC thin nuts are 30% lower than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/8 in., thin FLEXLOCs meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

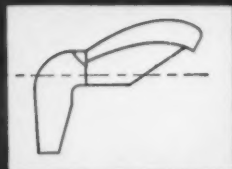
Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.
FLEXLOC LOCKNUT DIVISION **SPS**
JENKINTOWN PENNSYLVANIA

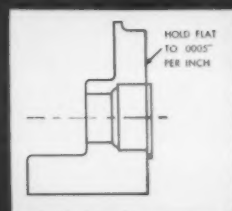
THE IRON AGE

Setup and Tooling Costs

ON THE HOUSE



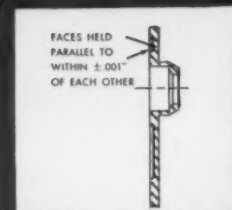
Part—Air-Gage Tracer. Operation—turn elliptical contour of 320° 15° angle on face and short O.D. on opposite end. Commercial—could not be turned economically prior to use of Air-Gage Tracer.



Part—Close Housing. Material—aluminum casting. Operations—turn, face and bore. Total machine time—3 minutes.



Part—Boreless Bore. Material—manganese steel tubing. Operations—face and bore both ends. Floor to floor time per piece—1½ minutes.



Part—Housing cover. Material—aluminum forging. Operations—turn, face both sides and bore. Floor to floor time per piece—4½ minutes. Previous production—7 pieces per hour.

How One Leading Contract Shop Affords It

What's the secret of absorbing these costs—with competitive bidding and profit margins as they are in the contract shop field today?

"Simple," says C. C. Gregson, President, Illinois Gage and Manufacturing Company of Franklin Park, Ill., leading supplier of highly specialized machining of aluminum and magnesium castings. "We are able to produce a better job faster and hold close tolerances more economically than shops provided with conventional equipment. Setup and tooling is so minor that in most instances

the customer is not even charged for it."

Note that phrase "conventional equipment"—it's the pay-off! The one 16" and the two 13" Monarch lathes you see pictured below are all Monarch Air-Gage Tracer equipped. So is the 10" Monarch that isn't in the picture. There's your difference!

To quote again, "we have found they speed up production anywhere from 10% to 90%." Air-Gage Tracers in your plant would likely enable you to realize similar savings. Why not investigate? . . . *The Monarch Machine Tool Co., Sidney, Ohio.*



Monarch

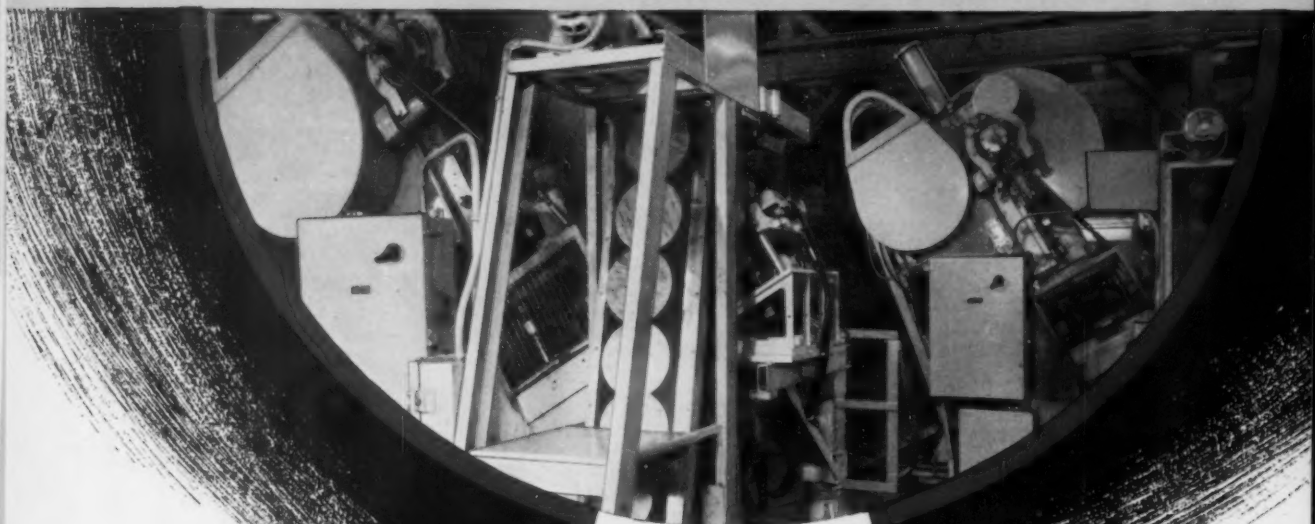
TURNING MACHINES

FOR A GOOD TURN FASTER
... TURN TO MONARCH

keyhole view of key operations in



4 NIAGARA AUTOMATIC OBI's PUNCH OUT



(Upper)

Two Niagara OBI's operate on each of the two G-E automated production lines at Building 85.

(Lower)

Fully automatic, 4 Niagara OBI's are fed by magnetized conveyor belts. Stator punchings leave press on upper conveyor and rotor punchings on lower, at rear of press. Scrap is discharged to under-floor conveyors.



Tri-Clad® '55' Motors such as this are manufactured in Building 85.

GENERAL ELECTRIC'S "SUPER SECRET" BLDG. 85 WHICH CUT MOTOR PRODUCTION TIME FROM 2 WKS. TO 24 HRS.

Strictly "hush-hush" for its first year and a half of operation, General Electric's now widely publicized Building 85 in Schenectady gives the rest of the metalworking industry plenty of food for thought.

Chopping down production time of 7½ - 30 hp induction motors, from 2 weeks to 24 hours, is no mean feat. G.E.'s medium induction motor department has done it with the very latest ideas in mechanized fabrication.

Helping to perform the important job of punching out lamination blanks for stators and rotors are 4 fully automatic Niagara OBI Presses. Each is equipped with General Electric ACA adjustable speed drives for maintaining flexibility in the flow of parts to meet market demands for 100 standard motor models . . . the very feature that Building 85 is famous for: *Variety and Automation, too!*

Fitting perfectly into the scheme of things at this, the most modern of electric motor plants, Niagara OBI's operate on fully automatic cycles. Automatically fed by magnetized conveyor belts, they likewise discharge their work automatically to the next operation. Metal waste is removed by under-floor conveyors.

Tough assignment for an OBI? Not for a Niagara! On last report, G.E. was getting 100,000 punchings per press from each set of dies

ROTOR AND STATOR LAMINATION BLANKS

between re-grinds. Longer die life is one of the assured benefits from the rugged, rigid, all-welded steel Niagara frames.

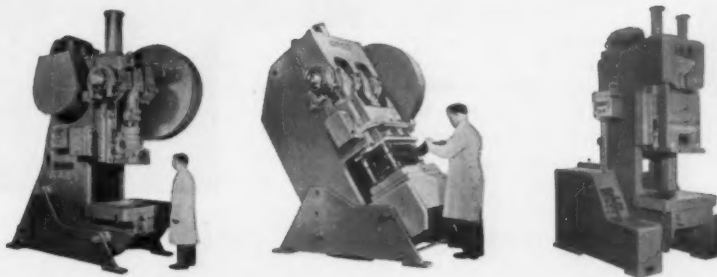
Pacemaker of the press industry, Niagara has the most to offer in OBI's . . . whether it's the Single Crank Electro-Pneumatic Clutch type used in this G-E plant, the Double Crank type for long die area work or the revolutionary new Front-to-Back Crankshaft design in automated or standard models. Now that you have the G-E story, get the whole Niagara story, too. Request literature.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries

NIAGARA OBI PRESSES



FACTS

about

NEW DEPARTURE BALL BEARINGS



FOR AIRCRAFT TURBINES

High speeds, high temperatures and heavy loads . . . both radial and thrust . . . characterize bearing applications for turbines used in present ultra-fast aircraft.

New Departure's Aircraft Bearing Research Program has produced ball bearings for highly satisfactory operation in small, medium and large turbines and their accessories.

Under this program, ball bearings of different steels dimensionally stabilized for high-temperature operation have been developed and produced. Needs for bearings with high-thrust capacity and varied lubricating methods have been met. And, bearings with various geometrical specialities to satisfy difficult mounting and operational requirements were designed.

Beyond this, New Departure is working on bearing developments for the more powerful, faster aircraft of tomorrow.

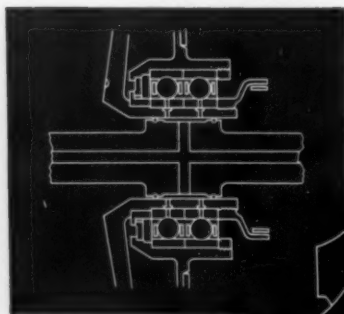
For further details, send for Folder TB, on turbine bearings.



Split Inner Ring
Main Shaft Ball
Bearing

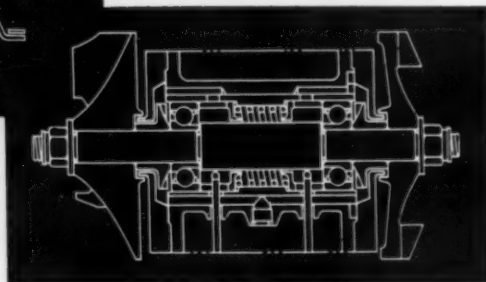


Accessory Ball
Bearings



LEFT: Split Inner Ring Bearings
on Turbine Main Shaft

RIGHT: Typical Installation
of Ball Bearings in a
Refrigeration Turbine



NEWSFRONT

Freight Embargo Stands

Scrap dealers don't like it, but appear ready to accept reluctantly railroads' refusal to supply freight cars for carrying shipments into Mexico. AAR order, affecting shipments brought to border points by truck or barge, curtails southward exports (247,000 tons in '55). Railroads cite freight car shortages, charge Mexican 'forgetfulness' in returning U. S. cars. They want more Mexican cars used.

ODM Wants Defense Metals Estimate

Office of Defense Mobilization wants Defense Dept. planners to hurry up revision of estimated mobilization needs of cobalt, molybdenum, tungsten and columbium-tantalum in case of emergency. ODM thinks growing needs for high temperature metals in jets, rockets, means stockpile goals, expansion objectives for these metals should be raised. Pentagon asks time, but ODM wants preliminary estimate pronto, to get own program in motion.

Aluminum: Continuous Vacuum Casting

Aluminum is being vacuum cast by a compact horizontal continuous vacuum-casting machine. Results are reported excellent. A pilot model of the machine, adapted for steel, is now operating in England. A production model for steel has been ordered by a German firm.

Better Tool Replacement Formula?

Sound—and so simple it's termed a swivel chair technique. That's how a new formula for making machine tool replacement decisions is described. Formula, expressed in what its developer calls a nomogram, even goes a few steps beyond the economics of equipment replacement. Claim is it can also determine the whole actual cost level of a manufacturing operation, indicate profits made almost at a moment's notice.

Boron Aids Automaker

Ford Motor Co., after considerable experimental work, is adding boron to its steel. Idea is

to improve quality of deep-drawing sheet metal, remove harmful effects of dissolved nitrogen, make it possible for steel to be stored almost indefinitely without becoming susceptible to the formation of stretcher strains.

Wanted: More 200 Series Stainless

Demand for 200 series stainless steel grades is on the upgrade. Latest result: one manganese refiner plans to announce a two-fold increase in production very shortly; attributes it in large part to increased demand for manganese-bearing 201, 202 stainless grades.

New Photo-Sensitive Paint Coming?

Research engineers at a leading motor company are working on development of a photo-sensitive pigment paint. If they can come up with it, all cars would be shipped from factory to the dealer in a neutral white shade. Dealer's cue would then be to custom-paint cars according to customer's wish, by playing a controlled electromagnetic radiation gun over the neutral white paint.

Research Pays 60-To-1 Return

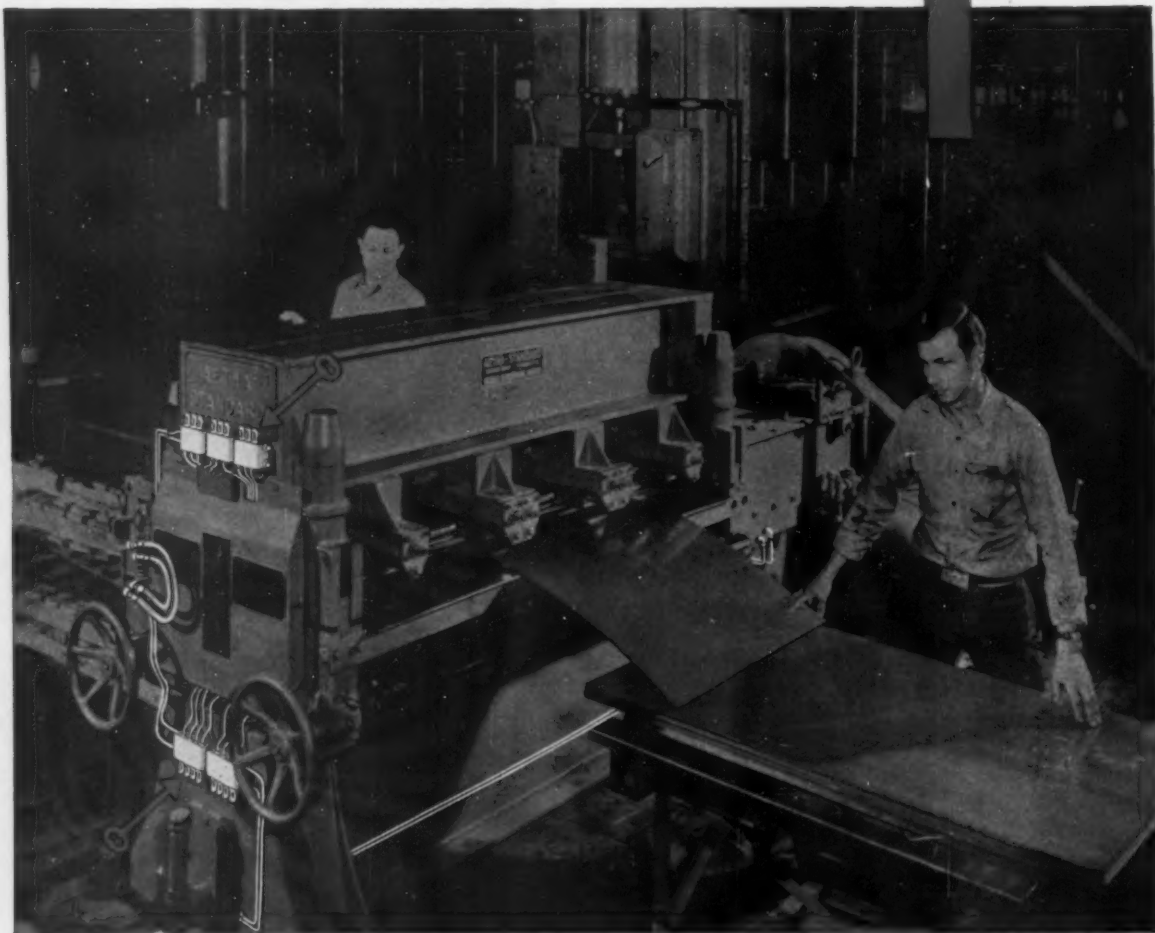
Science and engineering investments over the last 25 years have paid off an average \$60 for every dollar invested, according to one laboratory equipment industry spokesman. And it's a rising curve. In the next 25 years, he believes, the return will be as great or greater, raising productivity of the average worker from \$6000 now to \$9000 or \$10,000 by 1980.

New Air-Operated Radiography Camera

Now undergoing final field trials, a new kind of radiography camera uses compressed air to blow the active source into position. The unit projects the source out of the camera by way of a flexible tube to make an exposure. Air supply, 10 psi or less, can be from a high pressure air bottle or from a pumped cylinder. The maker is developing various types of head positioner to adapt the unit for tank weld inspection and other types of radiography.

Continuous, high-speed sheet levelling calls for continuous, precision lubrication

FARVAL—
*Studies in
Centralized
Lubrication*
No. 192



● Wherever high speed and heavy shock loads are involved, adequate lubrication of bearings is a must. It can't be a hit-and-miss proposition—there's too much at stake with costly machines and continuous production lines. The operation above is a good example. Here an Aetna-Standard sheet leveller flattens sheets at high speed. Failure or inaccuracy interferes with succeeding forming and stamping operations. With Farval on guard, such eventuality will not occur.

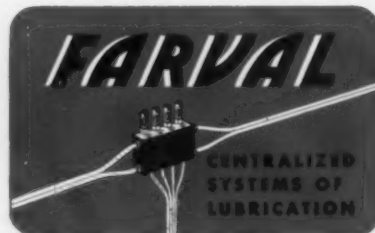
Farval delivers a measured amount of clean lubricant to every bearing at regular intervals. No bearings are ever missed—and the amount delivered to any bearing can be varied without affecting the rest of the system. Farval saves production hours, maintenance, labor.

Ask, now, for a free lubrication survey. Let us send one of our lubrication engineers to inspect your plant equipment. Without obligation, he will present a written analysis of what Farval can do for you. Write the Farval Corporation, 3282E, 80th St., Cleveland 4, O.

*Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing.
In Canada: Peacock Brothers Limited.*

KEYS TO ADEQUATE LUBRICATION—
Wherever you can see these Farval manifolds, dual lubricant lines and central pumping station, you know a machine is being properly lubricated.

Here, Farval serves an Aetna-Standard leveller in an Ohio metalworking plant.





Steel Heading For Overdue Stability

Strike or not, steel industry is due for a period of stability in labor relations . . . A compromise on 3-year contract predicted . . . Benefits to industry and its customers will be many—By Tom Campbell.

◆ **WHEN THE** steel labor wage settlement comes this weekend—or at the end of a strike—it will spell real stability in the steel industry for the first time in its labor relations history.

Best bet is: the contract will run for 3 years with no reopening. The package for the first year will cost a few cents more than the 17 $\frac{2}{3}$ ¢ originally offered by the industry.

Chances are a face-saving device for both the union and the companies will be something close to 20¢ an hr the first year with a shuffling around of some of the extensive benefits in the initial package handed to the union more than two weeks ago.

By Saturday it will be clear whether there will be a strike neither side has planned for—or wants. The bargaining behind the closed doors has been a little rugged. What was shown to the press was window dressing and a bid for public support.

Government Watching

If by some miscalculation the steel company negotiators hold tight for the 5-year contract with no reopener, then there will be a bitter strike and deterioration in labor-management relations. But the steel negotiators, especially John A. Stephens, U. S. Steel's veteran dealer with the union, must have known they were going to put Dave McDonald on the rack with their ultimatum of "no change" in term and total cost. That's part of the game, just as the union's television pitch, battle of the statements and letters to members are part of the show.

The Administration will keep out of this fracas. The U. S. mediation boys will be rushed in if things look messy. They have been standing close by for days. There will be some pulling and hauling backstage by some Administration people if it looks as if a labor tieup of steel might hurt Ike's chances for reelection.

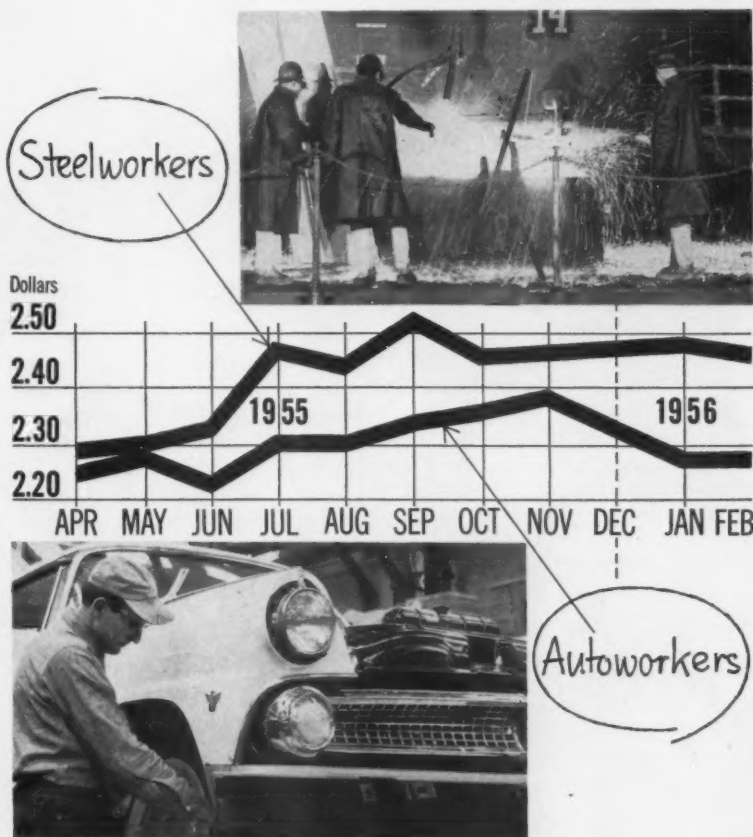
But any interest by Washington will be purely in the top-secret classification. It would be naive to think that political strategists were not talking to the right people from time-to-time.

Price Boost Estimate

Before Dave McDonald gets out of the steel sweatbox this week he

Steelworkers vs. Autoworkers

Average Hourly Earnings



Tungsten:

U. S. mines are facing a cave-in.

♦ **LIFE OR DEATH** of the domestic tungsten mining industry hinges on a bill scheduled to come up before the House of Representatives on July 5. The bill, already passed by the Senate, would continue the government's tungsten purchase program for another 30 months.

Stiff opposition is expected in the House. If the measure does pass, it faces possibility of a veto by President Eisenhower. Last year, the chief executive declined to sign a similar measure.

More than 700 mines are faced with indefinite shutdown.

Because of the high cost of do-

mestic tungsten, little aid is expected from private industry which last year purchased 8,967,000 lb of the metal in the foreign market.

Domestic tungsten's sole customer, Uncle Sam, has completed stockpiling 3 million units of the strategic material authorized under the Law of 1953. The law pegged the price at \$63 a unit compared to \$41-\$43 on the world market.

Production High

Tungsten mine operators say the \$18-a-day wage they must pay for labor puts them out of the running with foreign producers who pay as little as \$2 a day.

Adding to the plight is the probability that China will enter the world market later this year and undercut everyone at \$33.50 per unit.

Foreign producers are further aided by the administration's

Point Four program, which allows tungsten to be shipped into the U. S. at the low duty of \$7.93 per unit, according to the Tungsten Institute.

Availability of domestic tungsten is no problem, the Institute points out. Last year, the mines turned out more than one million units—about 1.6 times the amount consumed by private industry.

Two rays of hope have appeared on the political horizon.

First, newly appointed Secretary of the Interior Fred A. Seaton told the Senate that he will present the next Congress with a long-range program for minerals. Tungsten will be included in the plan.

Secondly, Sen. James Murray (D.-Mont.), chairman of the Senate Committee on Interior and Insular Affairs, announced that the Dept. of Defense has abolished all restrictions on use of tungsten in jet aircraft.

STEEL LABOR *Continued*

will probably have tried to enlist the help of Benjamin F. Fairless, former U. S. Steel chairman in whom he has great confidence. Mr. McDonald's right hand, Arthur J. Goldberg, union legal brain, has indicated that the union needs Mr. Fairless, who has been absent from negotiations thus far.

After the smoke clears and the contract is signed, with the usual handshaking and smiles, steel prices will go up. They will go up around \$10 a ton if the first year's cost of the package is around 20¢ an hr. After that, it will behoove the steel user to grab a copy of the contract. Only by checking its fringe-and-wage-increase timetable will he find out when and how much prices will go up in the future.

There may have been a miscalculation by steel negotiators. They have been sitting in the driver's seat for the past week or so. During that time, Dave McDonald has been trying to figure how to get out of the corner. He's a tough guy to pin down for long. If, as expected, he gets a face-saver,

then he will be happy with a contract that will carry out some of his own preaching—stabilization in steel.

Steel Needs Money

The industry had to take a stand some place if it wanted to get out from under the general, if unfair, accusation that it has been "feeding the fires of inflation" for years by acquiescing to round-after-round of wage and price increases. And besides, steel users want steel when they need it. They don't relish this hedging and piling up of stock on borrowed money to beat a price increase or a strike each year.

The 3-year program for 15 million tons of new steel capacity demands a big earning rate for steel, stabilized operations, and room and time for calm planning. A contract reopenable in 3 years will do that. A cost of 20¢ the first year with a smaller cost in the second and third years would mean much smaller price increases in the second and third years, better productivity and, perhaps, better labor relations.

If you are a steel user, you can begin to map your course by figuring that for 3 years, at least, steel on hand is money in the bank, no matter what the Federal Reserve Board index shows. You can bet, too, that the stability coming to the steel industry will be the pattern in industry generally.

Peaceful Settlement?

The industry figures its 5-year package is worth 65¢ an hr, and that it is the most liberal it could present short of contributing to inflation. The union's rebuttal has been weak. Its point that the workers were getting 5¢ an hr take-home pay did not recognize that many of the benefits are not pay envelope improvements, but they are a company expense nevertheless.

If there is a strike, it may be worth it, according to some people, to get the stability that is bound to come. But in the last analysis, perhaps the best guess is that present toughness is window dressing and bargaining by both sides will produce a settlement.

HEAT PUMPS: They've Come of Age

New technical developments pave way for large scale use of these units for home and industrial heating and cooling . . . Growing sales reaching total of 861,000 units by end of 1965 are foreseen—By G. G. Carr.

♦ **YOU HAVE IT LUCKY.** It just seems like a hundred years while your children grow up. The air conditioning industry has had to wait over a full century for the heat pump, one of its most promising children, to mature. But York Corp. is now betting that it has evolved the formula to raise a promising child to highly saleable maturity.

York is basing its hopes not on a new scientific discovery but rather on adaptation of a principle well-established in the refrigeration industry—compound compression.

Leads Dual Life

Big difference between heat pumps and conventional cooling appliances is that a heat pump both heats and cools. If your house is cold, the heat pump will circulate the extracted warm air; when the outside mercury climbs, the pump circulates the cool.

For its double life, the heat pump relies basically on a compressor—again like your refrigerator and air conditioner. Practical difficulty to date has been creating a conventional single stage compressor, and heat pump, that could operate economically using outside air at temperatures much below freezing.

The refrigeration and food freezing industries have long used compound compression to achieve economically the low temperatures desired. York's new system, developed by Robert G. Werden of its sales engineering staff, adapts this principle to the heat pump to extract sufficient heat from cold outside air. Compressors are moved automatically from single stage

to compound compression when the outside temperature drops below a predetermined point.

York now has one of its compound compression heat pumps operating in a Roanoke, Va., department store, with another slated for a new office building in Philadelphia. Recent announcement of the new system has brought a host of "hot inquiries," a company spokesman reports. So far, only large custom installations are available, but York is pressing miniaturization into a package unit for home sales, hopes to hit the market with it in '57.

Six Point Pitch

Their sales pitch stresses these points:

1. Initial cost is lower than conventional heating and cooling installation.
2. Compound compression, by eliminating booster heating strips, brings cost of electricity to run the unit far below fossil fuel costs for comparable conventional heating rigs.
3. Heat pumps require little supervision or maintenance.
4. Compound compression makes air source units completely practical, and air units are far and away cheaper to install than water or earth source pumps.

In commercial buildings, the now-practical heat pump saves valuable space for productive activities. "Put your furnace on the roof," is the slogan.

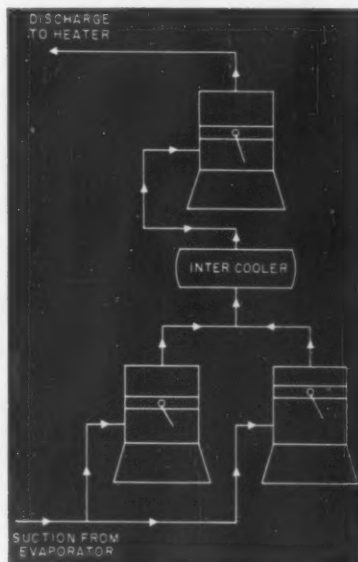
Opinions Differ

An IRON AGE sampling of major heat pump and air conditioner producers shows they all have the York development under careful study. But there is disagreement. Some engineers feel that they have under development

better ways of achieving the same results without compound compression.

Just how big is the market? There are easier questions. Prior to the York development, General Electric had estimated that in 1956 the industry will sell 10,000 packaged units for a cumulative sales total of 19,000 through this year. About 60 pct of the '56 sales are expected to be for residential use, whereas the split between home and commercial in the past has been about 50-50.

GE further estimated that sales in 1960 would hit 50,000 and 209,000 in 1965 for a cumulative total of 861,000 by the end of that year. Even more exciting than the figures is the company's prediction that heat pumps will ultimately "outstrip any other electricity-consuming device except TV.



SCHEMATIC sketch illustrates compound or multi-stage compression used in the York heat pump system.

HIGHWAYS: Get Ready to Roll

Interstate system of 41,000-miles of highways is now approved . . . Eventual cost will be \$100 billion . . . It means big business for suppliers for years—By G. H. Baker.

♦ **THE GREATEST** roadbuilding program ever undertaken at any time by any nation is ready to roll. A politically bipartisan program, it has the thumping endorsement of the Eisenhower Administration and of virtually every member of the Senate and the House of Representatives.

New roads are going to lace the country in a 41,000-mile network of wide, skilfully constructed highways that will link nearly all cities of 50,000 population and over. It will provide new thoroughfares into urban areas and improved road systems to speed rural residents to and from local markets.

Demands on American industry to supply the planning, labor and materials for his vast operation will be towering. Going up steeply will be the need for structural and reinforcing steel, cement, sand and gravel, lumber, and explosives. Requirements for concrete pavers and spreaders, batching plants, finishing machines and truck mixers will soar.

There are to be savings in lives—perhaps 3500 a year—and in the long run costs of moving private and commercial vehicles from point to point. Though the taxes on individual car owners and truck and bus companies are

raised, eventual savings are certain in reduced brake and tire wear, fewer traffic delays and lower insurance tabs.

Who'll Pay?

Taxes, new and increased, on fuel, trucks, buses, truck-trailers, tires, and retread rubber are to create a highway trust fund from which money will be distributed to the states on a pay-as-you-build basis. Outlays in any year are to be no more than the anticipated amount in the trust fund for that year.

Motorists who now pay 2¢ per gal federal gasoline tax will start paying 3¢ per gal July 1. The same rates will apply to other fuel. Federal tax on tires, now 5¢ per lb, will go to 8¢ July 1 and a new tax on retread rubber will be established that date at 3¢ per lb. Federal tax on trucks, buses and trailers, now 8 pct, will become 10 pct. The special use fee for trucks and buses of over 26,000 lb gross weight will go into effect at \$1.50 per 1000 lb.

Congress authorizes federal-



**Highway Steel Needs
Will Multiply**

♦ Engineers figure between 420 and 450 tons of steel go into every \$1 million worth of new roads. This does not include construction machinery or other secondary uses.

On that basis, the total federal-state road program will require in the neighborhood of 23 million tons of steel directly,

plus many millions of tons for uses indirectly connected with construction.

Total annual steel needed for all types of road construction will probably top 5.5 million tons for both the new road program and normal state and Federal roadbuilding, one expert says. This is more than seven times the amount used in 1954.

Construction Equipment Will Boom

♦ Sales of highway construction machinery, now jogging along at a comfortable but not spectacular rate of \$2 billion annually, will triple within the next five years, as a direct result of the new road program.

The industry has been running at slightly more than 50 pct

of capacity, can take up some slack before it has to expand its capacity.

Fabrication Will Tend toward Standardization

♦ More standardization of steel fabrication is being insisted upon by federal highway officials. Bridges, for example, are to be standardized in every possible case. Up to now, bridge designs varied widely, thus running up the costs of design and fabrication. From here on, local architects must bow to Washington's ideas on bridges. The upcoming GI-issue bridges may not be as pretty, but they'll be cheaper. Procedure is expected to maintain efficiency, while decreasing the high overhead.

What Highway Program Means



A NETWORK of wide, well engineered highways stretching from coast to coast will be the result of the new \$100 billion interstate highway program.

state spending of \$32.9 billion in the next 13 years to pay the bills, but that figure obviously is little more than a starter. This authority allows for completion of the new interstate traffic belts, but only three years' work on primary and secondary roads.

There are certain, after three years, to be further outlays for these roads, and more unmet needs of various types will be seen and money apportioned to meet them.

The eventual total expense for all new and improved construction

should be around the \$100 billion named in the Clay Committee report of 1954.

Federal share of the \$32.9 billion is to be close to \$28 billion, of which nearly \$25 billion is bound for interstate highways. Another \$2.5 billion will go to the states in the next three years for primary, secondary and urban roads.

Nine-tenths Federal

Nine-tenths of the cost of building the interstate net is to be covered by federal funds. This money is to be allocated to the states during the first three years by a formula involving population, area, and rural route mileage. After that, distribution will be geared to state needs, as decided in an official study still to be made.

Apportionment in the initial three-year period will give close to

one-third of all federal road money to the populous, heavily-industrialized states in the Great Lakes region, according to current estimates. New York, Pennsylvania, Ohio, Indiana, Michigan, Illinois, Wisconsin and Minnesota are to receive slightly more than \$2 billion, compared with less than \$365 million for New England.

Breakdown of the government money available to the Great Lakes region in fiscal 1957 alone and in the fiscal years 1957-59 shows the following in millions of dollars:

State	1957	1957-59
New York	\$ 78.9	\$ 451.3
Pennsylvania ..	59.7	341.3
Ohio	47.8	275.2
Indiana	27.2	158.5
Illinois	52.7	304.2
Minnesota	25.5	149.9
Michigan	40.4	232.7
Wisconsin	25.6	149.3
Totals	\$357.8	\$2,062.4

Study Toll Roads

Fate of the toll roads as related to the new highway program will depend on results of a two-year study by the U. S. Commerce Dept. A House provision would have permitted Congress to reimburse states for those roads which could be incorporated into the interstate system. Instead, the study is to determine if reimbursement would be feasible.

to Metalworking



But Truck Freight Costs Will Climb

♦ If you ship by truck, get ready for another boost in your freight costs. Operators of tractor-trailer rigs will have to pay substantially higher taxes to pay for the new roads, and all of them expect to pass on the higher freight charges to you their customer, completely in most cases.

How Big Is the Road Program?

♦ The new roadbuilding program is the biggest public works project since the ancient Egyptians built the giant pyramids along the Nile.

It is the largest roadbuilding program in the history of the world. It is the most expensive, and will involve the largest volume of physical construction and the greatest volume of materials.

The total sum to be spent — \$100 billion — is about 32 pct more money than is spent annually by the federal government for all purposes.

By way of comparison:

The Panama Canal cost only \$380 million, of which \$40 million alone went to pay the French for rights and did not figure in the digging costs.

The St. Lawrence Seaway is going to cost about \$87 million, less than 1/1000 of the total cost of the road program.

PAPER: New Market In Metal Unfolds

Metalworking firms find paper valuable as protective wrapping for finished products . . . Chemically-treated, rust-prohibitive packaging is latest boon to industry . . . Sales multiplying—By K. W. Bennett.

◆ THE NEVER-ENDING search for improved methods is bringing together two industries as old as civilization itself—paper and metalworking.

Alert research is uncovering a vast market for paper in protective packaging of steel, as industrial wipers in metalworking plants and for interleaving of tinplate and stainless steel.

Many Applications

One mill is currently buying \$20,000 worth of interleaving (paper fed into a coil of continuous steel sheet at the coiler) per month for its stainless production alone. Another large mill bought 1,173,000 lb of corrugated paper last year; 770,000 lb of waterproof

paper; 265,000 lb of water repellent paper; wrapped its tinplate in another 380,000 lb.

Add 20,700 lb used to protect newly dressed millrolls and this mill used a minimum of 2.5 million lb of protective paper and is increasing its consumption.

Waterproofing

In a general product line steel mill, about one-half lb of paper per ton of steel produced goes into wrappings alone. If stainless is produced, or bulks large in total output, the figure may be considerably higher.

Hot rolled pickled sheet and strip are being wrapped in water repellent paper or in a double jacket of water repellent paper

and reinforced waterproof paper. Cold rolled cut sheets are being packaged the same way.

Galvanized sheet, despite its protective coating, is being packaged in 50 lb kraft laminated paper with 80 lb asphalt; in waterproofed paper, or in corrugated paper. Cold rolled coil is going to the customer in waterproofed and fiber reinforced paper (with glass-and-rayon or glass fibers only, as opposed to jute and hemp formerly more extensively used).

First in South

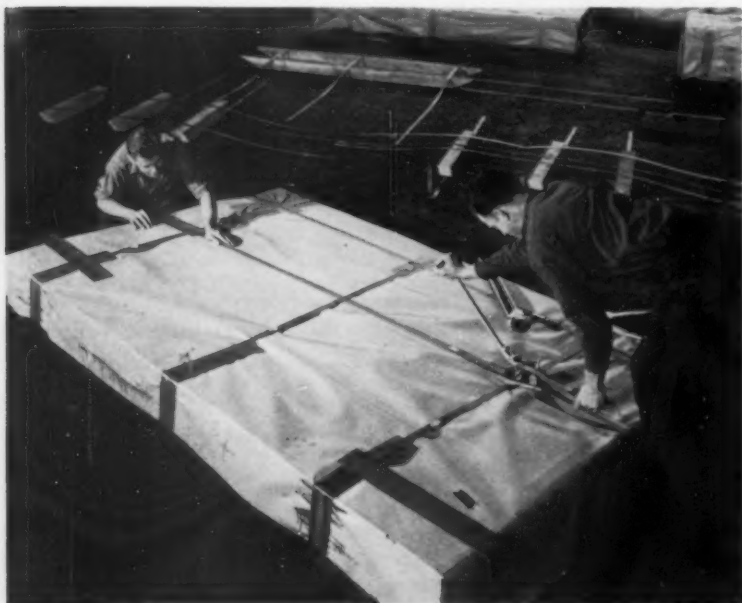
Tinplate is leaving the mill in tin wrap paper, 50 lb creped Kraft laminated with 80 lb asphalt, and with an additional corrugated paper jacket outside.

Coming up from the humid South is the VCI paper (vapor corrosion inhibiting paper) that carries a chemical to keep down rusting due to humidity. Steel mill paper buyers report using it in Southern operations earliest, but its use is now widespread in the North. It's already marketed under a number of trade names, is regarded by many as the fastest comer in the paper-packaging-for-steel picture.

Shell Oil Co. holds the patent for this paper which it calls "VPI" (Vapor Phase Inhibitor), and issued licenses to these firms:

Angier Sales Corp., Framingham, Mass.; American Reinforced Paper Co., Attleboro, Mass.; Hinde & Dauche Paper Co., Sandusky, O.; Marvellum Co., Holyoke, Mass.; Orchard Paper Co., St. Louis; The Sisalkraft Co., Chicago; Excello Paper Products, Cincinnati; Miami Valley Coated Paper Co., Franklin, O.

Hot at the heels of paper wrap-



NEAR MAXIMUM PROTECTION from moisture is assured this shipment of cold-rolled sheets at Inland Steel Co. through use of vapor inhibiting paper. It is one of many new applications of paper in metalworking industry.

pings is the use of paper wipers, a replacement for the hank of cotton waste, usually dangling from the right rear pocket, that used to be a trademark of machineshop veterans. Major producers of paper products began hitting this market earlier, but have far to go.

Paper wipers came in during World War II, but have begun to step ahead rapidly in the past two years. Confided one steel man, "We're really getting a lot of sales pressure." Said a paper salesman, "We regard this as a major industrial use for paper, and we've just begun to scratch the surface."

Ad Gimmick

Recent can industry developments suggest more paper in that area—notably increased VCI packaging for blackplate—as well as interleaving for tinplate in continuous coils. For the steel companies, paper packaging has proved a minor boon in providing additional space to put the trademark where it can be seen.

One Midwestern mill began stamping paper packaging with its trademark, a wave of competitors followed suit, and as late as last month another major steel producer informed a paper supplier that in the future it wanted its packaging material imprinted with the steel company's trademark.

Bandwagon Rolls

The paper industry is huge, but names already well established in the industrial field include Cromwell Paper, American Sisalkraft, Thilmany Paper; and producers Scott, Kimberly-Clark, International Paper and scores more, with the number increasing yearly.

That tired hank of cotton waste isn't all that is going to go if paper producers are calling their cards correctly. Kimberly-Clark is testing throw-away clothes made of paper and includes industrial coveralls, policemen's ponchos, restaurant aprons, and hospital gowns.

The list is almost certain to grow much longer as competing firms step up research programs.

TURBINES: Upstream Or Down

New unit is reversible . . . Generates electricity during peak periods . . . Converts to pump for storing water when demand falls off . . . Moving units biggest headache.

♦ **EFFICIENT USE** of America's water resources takes engineers along unusual paths. One of the latest developments is a reversible pump turbine for use in dams where storage ponds are available.

Used in conjunction with conventional one-way units, the pump turbine generates electric power during periods of peak demand. During low demand periods, the generator is switched over to act as a motor. The waterwheel then reverses to become a pump forcing water back to the top of the dam for use during the next peak demand when power commands a premium price.

Mighty Moving

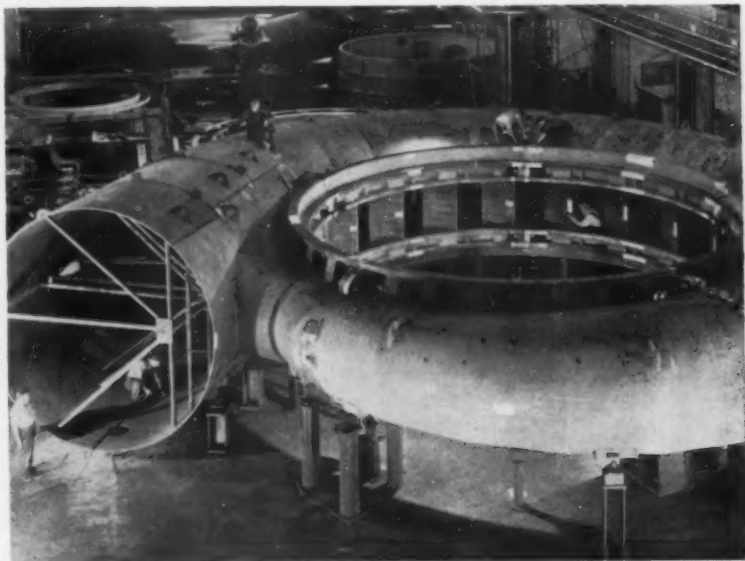
The world's largest unit, according to the Tennessee Valley Administration—with parts weighing over 1300 tons and requiring 50 railroad cars and 29 truck trail-

ers to move—has now been completed at TVA's Hiwassee dam in western North Carolina after 2 years installation work by the builder, Allis-Chalmers of Milwaukee.

The entire project cost TVA \$6.1 million including \$1.3 million for the pump-turbine and \$1.3 for the motor-generator. The new unit supplements an existing conventional 80,000 hp turbine. Its motor has a rating of 102,000 hp.

Cooling Contributes

Because of the monumental size of components, many were field welded at the dam site after laborious hauling through mountainous terrain. At the rail terminal of Turtletown, Tenn., parts were removed from the rail cars with manually operated chain hoists at a rate of 6 in. per hour. Trucks made the final haul.



NO GIANT CRULLER, this stay ring and spiral casing assembly will be used in reversible pump-turbine installed at TVA's Hiwassee, N. C., power plant.

MARKETING: Why Research Gets Results

Successful companies are relying more and more on market research for sales results . . . Knowledge of marketing factors is imperative on today's competitive economy . . . Accurate predicting is vital—By G. J. McManus.

♦ MODERN companies can't fly by the seat of their pants. Futures must be planned and the planning must be guided by scientific studies of markets.

In Pittsburgh recently, the American Marketing Assn. heard speakers cite demand for products as the key element in company survival and growth. Determining this demand, they said, is an important job, rating the full-time attention of marketing specialists.

This view is gaining support in heavy industry, which is fast catching up with consumer lines in marketing techniques. United States Steel Corp., Jones & Laughlin Steel Corp., and Aluminum Co. of America were among the basic producers prominently represented at this year's AMA gathering. All have active market research programs.

Many Factors

Behind this specialized activity is the realization that a complexity of factors affects market

health. First, there is the overall economic picture. Some of the considerations here are discussed by Philip Wernette, professor of business administration at the University of Michigan.

He points to jackrabbit increases in population and income, says the United States will have 300 million consumers with over \$1000 billion to spend by the end of the century. Production must and will keep pace with this growth.

But other specialists warn against making such broad projections the basis for company expansion plans. David Melnicoff, business analyst of the Pennsylvania Railroad, points out that similar projections during the thirties fell way short of the production and income expansions that actually followed.

More important, he says, overall growth in the economy offers no guarantee that a particular company or industry will expand its market proportionately. In this

connection, he plugs THE IRON AGE, saying planners would do well to use it, or other sources in their own fields, to keep tabs on market developments.

Know the Product

The market analyst must be a product man as well as an economist. Also, he must understand banking. Many marketing men believe the current weakness in automotive lines can be traced to consumer credit trends. Pittsburgh banker James Land says that half the rise in personal income last year came from unsound increases in personal debt.

What's happening now, he feels, is that people are paying off last year's debts and this is reducing their new spending. Mr. Land sees the heavy debt burden bringing a general slump in the next few years.

Keep Up with Research

Another whole field for marketing men is technical research. The electrical and chemical fields were cited as examples of how fast research is changing markets. Eighty-five percent of RCA's business last year came from products and services that did not exist 10 years ago. Monsanto Chemical gets 45 pct of current income from products that are strictly postwar vintage.

Marketing people were told that this rate of change would continue and their companies would have to move with it.

But market people must also guard against discarding old products too soon. Radios, which appeared on the way out with the coming of television, have made a strong comeback.

All of which makes market predictions a tricky business.

Market Factors to Watch

■ **POPULATION** in the U. S. will be 300 million by the year 2000. Two-thirds of the increase will be in the dependent group until 1960. Labor force will increase by 800,000 annually until 1965.

■ **CONSUMER INCOME** will reach \$1000 billion by the year 2000. Debt servicing would call for one-third of disposable income by 1965 if it increased at the rate of the past four years. Bank failures reduced the money supply by 25 pct in the 30's. Last year bank suspensions took \$3 billion out of circulation.

■ **RESEARCH** pace of past 10 years left RCA with 80 pct of its business made up of new products. Biggest changes for future are predicted in nuclear power, electronics, plastics and automation.

EXPANSION IN INDUSTRY

Welding: **Lincoln begins work on** **\$8 million expansion**

Work is underway on part of an \$8 million expansion program at Lincoln Electric Co., Cleveland. By the end of this year, \$2 million worth of enlargement of manufacturing capacity for arc welding machines and electrodes is scheduled for completion.

Engineering plans are going ahead on remainder of the work, slated for the next three years.

Project will increase the company's manufacturing capacity by 60 pct through extensions to the 20-acre plant and installation of new equipment in existing production areas.

Other plans call for Lincoln to build new plants in France and Australia and enlarge its Canadian facilities.

Community Relations

Jones & Laughlin Steel Corp. will spend about \$1 million to alter layout of the slag processing facilities at its Cleveland works.

Project is part of J & L air pollution abatement program, and is not expected to boost efficiency of the operation.

In current location southerly winds blow steam from slag over nearby Clark Ave. Bridge. Company had invested more than half million dollars previously in an attempt to correct the situation.

Slag processing in the new location begins in nine months.

Electrical: **Westinghouse plans better** **equipment facilities, lab.**

Two major expansion programs—enlargement of manufacturing facilities at East Pittsburgh and addition to the firm's research laboratories—have been announced by Westinghouse Electric Corp.

The program at East Pittsburgh, slated to cost over \$1 million, is at the plant's transportation and generator division.

Addition to the company's research laboratories, located in Churchill borough, about 10 miles east of Pittsburgh, will consist of a new four-story wing. Construction will begin immediately with completion scheduled for late 1957.

Expansion Briefs

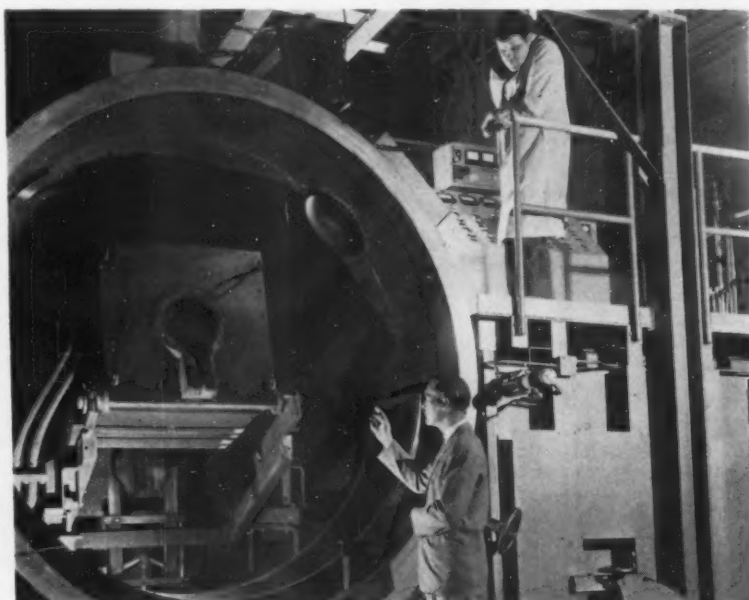
Union Carbide Caribe, Inc., subsidiary of Union Carbide & Carbon Corp.; building new ethylene glycol plant in Puerto Rico; cost about \$28.5 million.

Ford Motor Co.; construction bids for \$25 million aluminum castings plant to be built adjacent to Reynolds Metals Co. have been called for.

La Salle Steel Co., Hammond, Ind., plans extension to office building that will double present floor space.

S. Obermayer Co., forming Eosso-Ramtite Co., as subsidiary to manufacture materials for parent company's operating divisions—Obermayer (foundry facings) and Ramtite (plastic, castable and gun refractories).

Latest in Vacuum Melting



KEYHOLE-like opening is in the new 300 lb experimental furnace built by F. J. Stokes Corp., for Allegheny Ludlum Steel Corp. Unit is set inside the main vacuum chamber of A-L's new induction vacuum dept.

HOUSE ORGANS: They Can Save Money

Proper handling of editorial content can take your company paper out of the expense category . . . Methods for checking readership are simple but effective . . . Accurate reporting important—By R. O. Schulin.



◆ ENLIGHTENED management men generally concede that employee publications can be an asset—even show an indirect profit—if handled right.

There are a number of ways to check on what a publication is accomplishing, according to Philip M. Lind, past president of the Delaware Valley Industrial Editors Assn.

The checks used depend on what management wants the book to do. Assuming that your particular company internal organ is issued for the usual purposes of:

- 1) Putting across company policies;
- 2) Serving as a two-way communication medium between labor and management;
- 3) Improving employee morale;
- 4) Entertaining;

Then a systematic, periodical evaluation is relatively simple. Here are a few check points to learn if your publication is doing the job it's supposed to:

1) Discards. If the organ is distributed other than by mail, check

parking lots and sidewalks for discarded copies.

2) Extra copies. At distribution points, note how many additional copies employees take or ask for.

3) Informal interviews. Ask employees in various departments to volunteer opinions.

4) Questionnaires. Insert a questionnaire in each copy. Place return boxes at convenient locations—near timeclocks, for instance.

5) Contests. Have the editor publish employee participation gimmicks. Response should be high if book is well read.

6) Crusades. Inaugurate crusades confined entirely to the medium—such as a safety crusade or no-lateness campaign. Keep close check on statistics.

Help Available

For circulation to be considered successful, 90 pct of the copies should get into workers' homes, Mr. Lind says. And at home, an average of three people should read the company publication.

It is an editor's job to uncover

his publication's shortcomings. And in doing so, he might be surprised to learn that his "baby" is contributing to the company's economy without his knowing it. Safety campaigns resulting in reduction of accidents can lead to lower insurance rates and compensation costs.

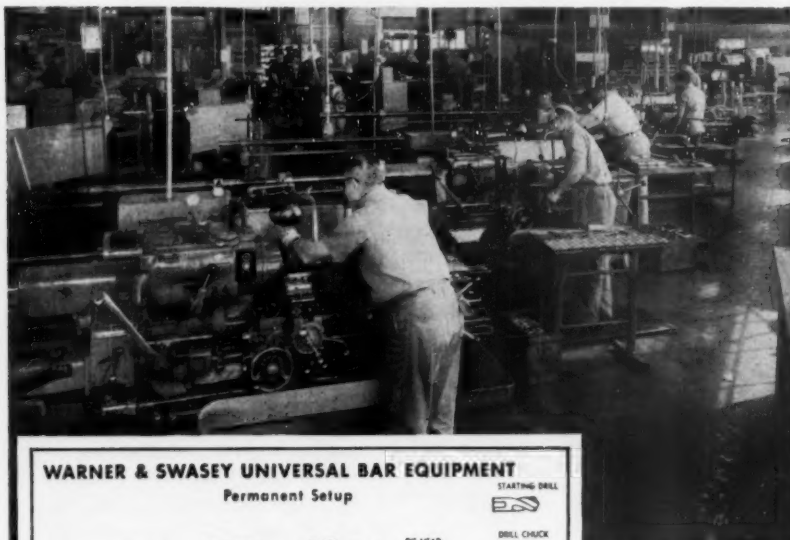
For example: the Bucyrus-Erie employee magazine "Scoop" recently campaigned for increased use of safety glasses in the shops. Result: there was a 30 pct increase in use of glasses and eye injuries decreased five pct. It is possible to achieve similar results in such fields as absenteeism, lateness and sluggish production records.

If the publication fails to produce results, the editor's work is cut out for him. It may be necessary to revamp the entire format or perhaps institute only one or two changes, such as:

- 1) Using more or less pictures, cartoons;
- 2) writing livelier articles;
- 3) getting more employee-written articles into the book;
- 4) using more local plant news.

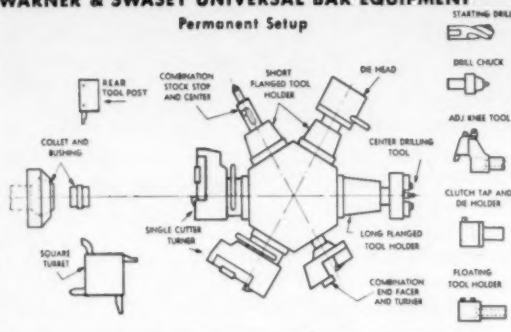
Here's a real case of SMALL LOT PRODUCTION

on No. 3 turret lathes at CAMCO, Inc.



WARNER & SWASEY UNIVERSAL BAR EQUIPMENT

Permanent Setup



Warner & Swasey Standard Tools are quickly interchangeable for simple and complex jobs—in large or small lots—thus minimizing your tooling costs.

CAMCO, INC., Houston, Texas, depends on Warner & Swaseys for small lot production of parts for their gas lift valves—equipment which lifts petroleum from oil wells whose natural forces are exhausted.

Two of these nine Warner & Swaseys are standard tooled No. 3 turret lathes which machine a wide variety of simple to complex parts from stainless steel and monel metal, in lots averaging 50 pieces. Tolerances as low as .002 are held on most jobs.

One of the No. 3's is also equipped with a full length lead screw and selective gear box to machine numerous small lot threading jobs. The threads are chased with the lead screw and an automatic knock-off attachment. Specification of the threads: standard vee or round form, special diameter, standard pitches, Class 3.

Since the day the first No. 3 machine was installed in 1954, working two 9-hour shifts per day, not one hour has been lost because of downtime for repairs! Similar performance has been achieved by their other Warner & Swaseys—No. 4 and No. 5 turret lathes, 2-A and 4-A heavy duty turret lathes, and two 5-spindle automatics.

This story again illustrates a point recognized in our customers' plants throughout the world—for dependable day-after-day production of small lots, you can't beat the versatility and accuracy of standard tooled Warner & Swasey Machine Tools!



CAMCO MACHINES
A WIDE VARIETY OF
PARTS LIKE THESE IN
6 TO 100 PIECE LOTS



**WARNER
&
SWASEY**

Cleveland

PRECISION
MACHINERY
SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

June 28, 1956

APPROPRIATIONS: Air Force Gets More

Congress votes Air Force \$17 billion . . . Army gets \$7.5 billion, Navy \$10 billion . . . Older services concerned about being relegated to "second class" . . . Nike vs Talos.—By R. M. Stroupe.

◆ CONGRESS, in keeping with national defense policies of recent years, is channeling to the Air Force a larger sum than will go to either the Army or the Navy. Estimated at about \$17 billion, the money is to permit speeded-up B-52 bomber production, and development of missiles.

With \$7.5 billion in new money, the Army contemplates no great changes in total strength, will continue to work on a number of advanced weapons. Navy atomic vessel construction will continue, backed by a \$10 billion appropriation. Large appropriation seems to have failed to muffle all complaints.

Some of the criticism comes from members of the two older services. Neither wants to become a second-class service.

This discontent was exhibited initially by the Navy during the "admirals' revolt" during the Truman administration. It is appearing again in the form of the Army claim (and objection) that it is being relegated to position of post-attack mop-up force and an armed custodian of industrial areas.

Missile Matters

One aspect of the Army's disagreement with the Air Force concerns the selection of missile for ground-to-air defense in this country. The weapon currently sited around some 18 industrial and urban centers is the Army Nike. Air generals are not impressed with its accuracy or range.

Apparently, Congress will accept the Air Force view that the Nike should give way to the newer Talos, which may be ready for full production early next year. In that case the Air Force may take over close-in defense stations.

Highest degree of heat has been generated on the question of intercontinental, or total war, military power. Provocative statements about deficiencies in the nation's capacity to fight and win a war against Russia have been made by Air Force and ex-Air Force personnel, and Congress.

Energetic Gen. Curtis LeMay, chief of the Strategic Air Command, cautions Congress that if B-52 output is not increased soon, by 1958 Russia will have twice as many planes of comparable type. By 1959 a crippling attack on the U. S. would be feasible. He asks more funds to permit spending more than \$8 billion a year to build up SAC.

As submitted to Congress, the fiscal 1957 Air Force budget contained \$5 billion for SAC. Senate Appropriations Committee, in a bipartisan move, has approved a \$1.1 billion rise in Air Force funds.

More B-52?

Aircraft buying, however, isn't going to swell overnight. Lt. Gen. Clarence Irvine, top Air Force logistics officer, says new purchases figure to be smaller than fiscal 1955.

Only six B-52 bombers are being built each month, and the rate is not expected to reach 20 per month for another year and one-half. Output could be raised to 45 per month, Gen. Irvine adds, if Congress demands it. In all, 600 of the planes are to be bought by 1959.

New warnings on the status of the ballistic missile program are given Congress by Trevor Gardner, former Air Force research chief, and Lt. Gen. Donald Putt, deputy chief of staff for development. They agree that funds for this work, to reach more than \$580 million in fiscal 1957, are adequate.

Defense Essentiality

Controversial theory that domestic industries should be granted protection from foreign competition on the basis of their essentiality in another mobilization emergency is gaining congressional favor.

A Senate-House economic subcommittee recently concluded the first phase of a proposed full investigation into the essentiality doctrine. Members of the subcommittee left little doubt that they agree.

The subcommittee opened its inquiry by reviewing the long-standing dispute over protection to the domestic watch manufacturing industry.

Tariff Trouble

In 1954, President Eisenhower raised the tariff on Swiss watch imports by 50 pct. Decision drew mixed reaction from Congress. Administration itself was reported split over whether the watch industry was capable of mass producing quickly the intricate timing and directional devices which would be needed in another emergency. The State Department and a host of U. S. industries which count on the Swiss as a market for their products promptly condemned the tariff increase, as did the Swiss and their watchmaking industry. Since the watch tariff decision a host of other industries have applied for tariff relief on the same grounds.

Essentiality relief is not easy to come by yet. Defense essentiality of a single industry is hard to prove, and refuses to stay proven—witness the watch industry which is for the second time in two years trying to show that its skills and capacity would be needed in an emergency, and in addition that tariff protection or subsidy of some kind is needed to protect those skills.



TIPS FROM A ROLL MAKER'S NOTEBOOK

MACKINTOSH-HEMPHILL DIVISION, E. W. BLISS COMPANY, Pittsburgh 3, Pennsylvania

Cast mill rolls • Johnston cinder pots • rotary tube straighteners • end-thrust bearings • heavy-duty lathes • steel and special alloy castings

Choosing rolls for slabbing and blooming mills

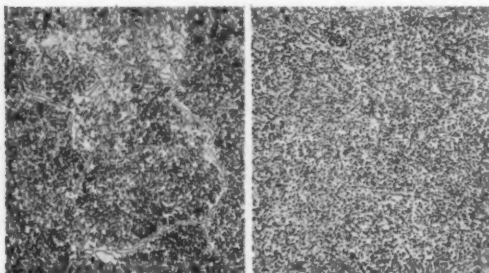
Cast steel rolls for blooming and slabbing mills must combine good resistance to fire cracking with the strength necessary to stand the severe stresses developed by these mills.

Other considerations that affect the choice of rolls include severity of the service and the method of roll cooling. Variations like these can mean good service from inexpensive rolls in one mill while in another the only practical solution lies in costlier, higher alloy rolls.

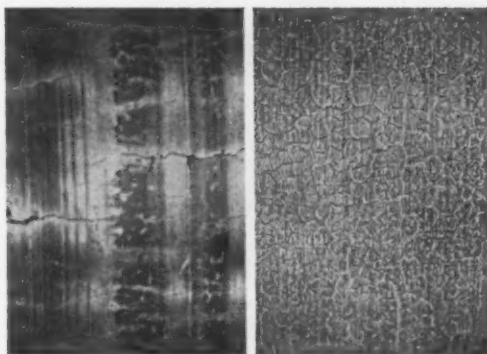
Two heat treatments—Heat treatment is used primarily to improve roll strength. However, heat treatment also affects resistance to fire cracking—metallurgists believe that there is a relationship between fire cracking and the elimination of the carbide network from the crystalline structure of cast steel.

Mack-Hemp has developed two heat treatments for blooming and slabbing rolls. The first is an air quench and draw, and develops maximum strength. It produces rolls with excellent resistance to the very severe localized concentration of stress that occurs each time the steel goes through a pass.

The second heat treatment, a double anneal, produces a spheroidized carbide structure with good strength and excellent resistance to fire cracking.



Carbide network (left) stands out clearly in specimen of roll with ordinary treatment. Pical etch, 500 magnifications. Network in Midland Superalloy (right) has been almost completely destroyed by special Mack-Hemp heat treatment. Pical etch, 500 magnifications.



Severe fire cracking ended the service life of the slabbing roll whose surface is shown at the left. Surface of Midland Superalloy roll at right shows excellent fire cracking pattern (roll had reached worn-out diameter after more than 600,000 tons).

Three types of rolls—Both of these heat treatments are modifications of older practices, designed to decrease the amount of grain boundary carbide in the finished roll, thus improving fire cracking resistance. Either treatment can be supplied in the three grades of Mack-Hemp cast steel rolls recommended for slabbing and blooming mills:

Midland Superalloy, a nickel-chrome-moly roll especially developed for applications where fire cracking is a severe problem. There are cases on record where sets of Midland Superalloy rolls have rolled 700,000 tons and more before reaching worn-out diameters.

Technalloy, a chrome-moly roll that has thoroughly proved itself under standard operating conditions.

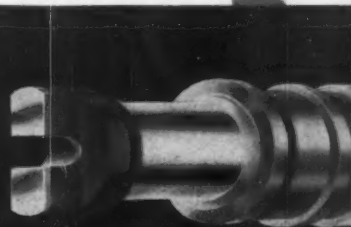
Technisteel, a carbon steel roll which gives good service at low initial cost under mild-to-average operating conditions.

Squeezing maximum tonnages from your mills... at minimum roll cost... is far easier when you enlist Mack-Hemp's aid. For help with your particular rolling problem, write us today.

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You get more tonnage from the rolls with the Striped Red Wabblers

Division of E. W. BLISS COMPANY
PRESSES, ROLLING MILLS, SPECIAL MACHINERY



HOW TO RUSTPROOF BLACK PLATE



Rust is a problem anytime, but it's particularly serious with black plate. On this light gauge, dry, uncoated steel, rust can start from a fingerprint. "Sweating" due to sharp temperature changes will cause immediate rusting on surfaces and edges.

Leading mills are now eliminating rust problems by packaging black plate in Ferro-Pak, Cromwell's volatile corrosion inhibitor paper. Chemical vapors from Ferro-Pak form an invisible film around the steel that prevents rust from getting a start, even when moisture is present.

The new Ferro-Pak sheet above was custom-made by

Cromwell's "Paper Engineers" to meet steel mill requirements for shipping black plate and dry sheet steel. It is water-proof, strong, yet highly flexible and easy to handle. Its chemical rust inhibitor is non-toxic . . . compatible with oil . . . stays effective for long periods even when the humidity soars.

Whether you're a shipper or a buyer of steel, it will pay you to specify Ferro-Pak wrapping wherever rust is a problem. For an interesting idea brochure on many uses for Ferro-Pak, write **Cromwell Paper Company, 4803 South Whipple St., Chicago 32, Illinois.**

FERRO-PAK® by Cromwell

"Paper Engineers"



RUSTPROOFING A FREIGHT CAR. Ferro-Pak is used to line sides of car and to interleave coils, transforming ordinary freight car into huge rustproof package.

REPORT TO MANAGEMENT

Business and the White House

Back in the autumn of 1955, a jumpy stock market rose and fell on the strength of what one somewhat cynical economist referred to as "Dr. White's market letters."

The President was then recovering from his heart attack and business was severely shaken by the possibility of his not running for re-election this year. The talkative specialist's pronouncements on the condition of Ike's heart then appeared to be the best information on his political as well as physical status.

There has been little tendency for business to be as skittish during the President's current illness. (The point can also be made that the stock market's short term fluctuations don't necessarily represent business opinion.)

There is no lessening of the general opinion among businessmen that Ike's presence in the White House for another four years is desirable. But business isn't going to be stampeded by factors it can't control.

There has been, instead, a buckling down to work to meet what might be a third quarter letdown head on, to make sure that its effects are minimized. Above all, there is little tendency on the part of business to pull in its horns, or retrench on capital spending plans for merely political reasons.

What's the Summer Outlook?

Purchasing agents, who are the first in the business ranks to reflect new policies, look for a pickup late in the third quarter, according to a survey of the National Assn. of Purchasing Agents.

A general but moderate decline in the business pace is reflected in the PA's replies. Twenty-five pct report an improvement in new orders, while 28 pct observe reduced orders in June. A total of 46 pct report their

expenditures for plants and equipment will continue at rising rates, 54 pct report a leveling off.

Inventory policies indicate that a period of inventory control is in the cards, with a diminishing tendency to accumulate goods against market uncertainties. In June, 31 pct reported higher inventories, 50 pct no change, and 19 pct less than in May.

On buying policies, 27 pct of the purchasers are buying on the 30-day range, 32 pct in the 60-day range, while only 5 pct are buying hand-to-mouth. Capital purchases stay in the 120-day range.

Higher prices were paid in June for aluminum, some steel items, phenol, alcohol, paper, lumber, gasoline, and electrical equipment. On the down side were brass, copper, copper and steel scrap, mercury, ammonia, waste paper, rubber.

Still remaining in short supply were aluminum, some copper products, and nickel. Structural, alloy, plate, pipe, stainless, some sheets and shapes were steel products still on the tight side.

Some Points to Consider

Although money may be tight, business borrowing continues at a high rate. In the week ended June 13, loans to manufacturers of metals and metal products accounted for \$114 million of the total \$277 million increase in loans to business and industry. This was the largest weekly increase since the quarterly tax date in March.

Deliveries of new freight cars in May totaled 6667, highest number since 1953. As a result of the high rate of deliveries, backlogs were reduced to 133,072 cars on order and undelivered.

Summer heat had its effect on the electrical industry too. Electricity use soared in the second week in June to a summertime high as sweltering residents turned on air conditioners and fans.

INDUSTRIAL BRIEFS

Ike Recommends . . . President Eisenhower is proposing Marling J. Ankeny, former Bureau of Mines safety director, as the new head of the Bureau of Mines, the first person to be nominated by the new Secretary of Interior, Fred A. Seaton. He will succeed John J. Forbes as director of the Bureau.

Power Play . . . The Fluor Corp., Ltd., Los Angeles, engineering construction firm, has been awarded a contract to design, erect and supervise the preliminary start-up of the second of four 60,000 kw steam electric generating units for the California Electric Power Co. at its new San Bernardino steam plant.

Model Operation . . . Laclede-Christy Co., Div. of H. K. Porter Co., Inc., is installing a quality control clay testing laboratory in Fulton, Mo., which will run tests for shrinkage and other physical properties.

Brass Reinforced . . . Ivy H. Smith, Jacksonville, Fla., and M. E. Capouch, Cleveland, O., have been named president and vice-president respectively of the Wire Reinforcement Institute for the coming year.

Big Splash . . . Officials of the Dow Chemical Co. and Bay Refining Corp., Midland, Mich., are considering acquisition of Bay Refining by Dow. Dow's Midland Div. has an option to buy Bay Refining and its associate, the Bay Pipe Line Corp., both headquartered at Saginaw, Mich., and with operations in Bay City, Mich.

Selling the West . . . Pesco Products Div., Borg-Warner Corp., is opening offices in Los Angeles, Seattle and Wichita to handle direct sales of its fuel pumps, hydraulic pumps and other products.

Getting the Most . . . Fansteel Metallurgical Corp. has established a metallurgical consulting service under the direction of Raymond W. Yancey, chief metallurgist, to aid and instruct customers in achieving best results from refractory metals and components made from them.

Empire Action . . . The New York Air Brake Co. has appointed Nielson Hydraulic Equipment, Inc., New York, to handle the Hydreco-Dudco industrial line of hydraulic pumps, fluid motors and valves. New distributor will handle sales in the New York Metropolitan area and Westchester county, northern New Jersey and southern Connecticut.

On the Cuff . . . Employees of the James B. Clow Co., Birmingham, Ala., manufacturers of cast iron pipe, have formed their own credit union. In the primary metals industry, employees now operate over 700 credit unions, according to the Credit Union National Assn. There are more than 21,600 credit unions with 10 million members in North America.

CCCC = CCC and CFC . . . The formation of a new company, Cochran Continental Container Corp. has been announced by Continental Can Co. and Cochran Foil Co. Owned equally by Cochran and Continental, the company will combine facilities and organization of the Cochran Products Div.

Latin American Highball . . . Railroads in Chile and Brazil have signed contracts with the International General Electric Co. for a total of \$9 million in locomotives. As part of a \$4 million order, the Chilean State Railways has bought the first locomotives of a new universal line recently developed by GE's Locomotive & Car Equipment Dept. for use on foreign railroads.

Higher Mathematics . . . McDonnell Aircraft Corp., St. Louis, has established a research department to supplement and contribute to work now being conducted in its airplane, helicopter and missile engineering divisions and flight department. Primary projects are the design and development of specific aircraft and weapon systems.

Blank Form . . . Worcester Pressed Steel Co., Worcester, Mass., has added to its facilities a 400-ton blanking, forming and multiple operations press of a type rarely used outside the automotive industry.

Piggy Goes to Market . . . The first ten piggy-back freight cars to be sold to Cuba have been delivered to the Consolidated National Railroads of Cuba. Piggy-back freight cars have been designed and built with wells to securely hold double-mounted rear truck wheels. The cars are 40 ft long with a 50-ton capacity and were built at the Landisville, Pa., plant of Rail & Industrial Equipment Co.



"Have a seat, fellow directors!"

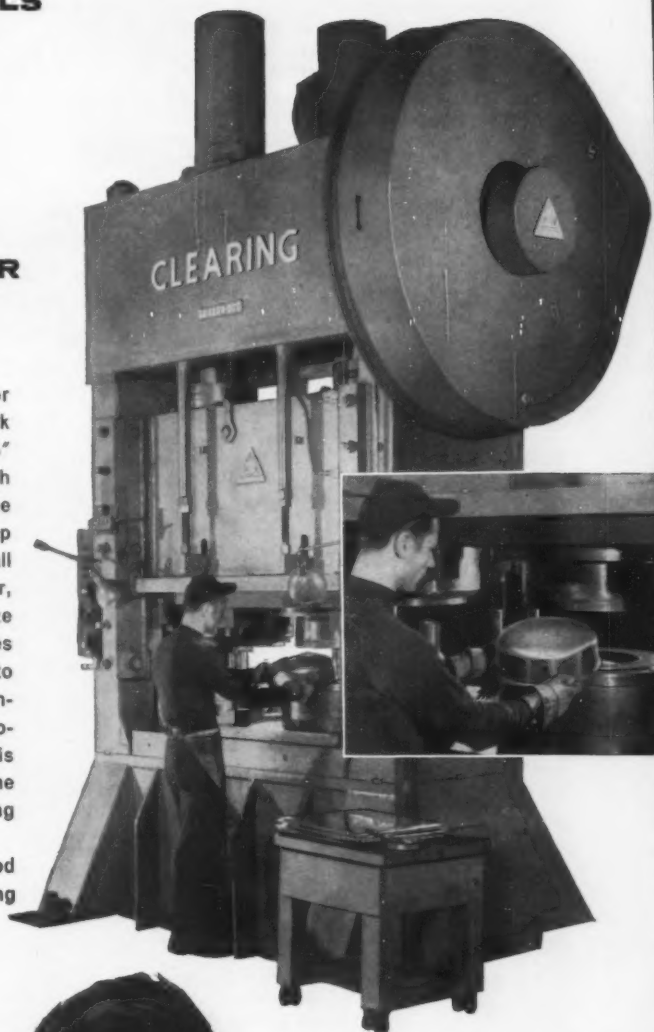
PRODUCING PRESSURE VESSELS

Profitably

CLEARING PRESS RIGHT ANSWER FOR TAIT MFG. CO.

Tait Mfg. Co. in Dayton, Ohio found the right answer for production of pressure vessels in the Clearing double crank press shown here. The vessels are produced from .025" stainless steel blanks which are drawn to a depth of 5". High blankholding pressure (70 tons) required at the start of the draw requires that the press develop high tonnage 5" up from bottom stroke. Normally these requirements would call for a press far larger than the one shown at right. However, Clearing engineers designed the press with an oversize drive—a 500-ton drive in a 250-ton frame. Two sets of dies are used in the press, one to trim and draw, the other to pierce and emboss. The press is equipped with two cushions in the bed. Seventy tons of cushion pressure is provided on the draw side for blankholding. This pressure is reduced to 35 tons automatically at a point $1\frac{1}{2}$ " down on the draw. The other cushion provides 10 tons of stripping pressure.

If you are looking for an efficient and economical method to produce your product more profitably, call on Clearing Machine Corporation to discuss your problem.



Write for colorful brochure,
"Thinking about a better way to
do the job?" No obligation.



This Clearing double crank press with an oversize drive develops high tonnage five inches from bottom stroke, easily solving the problem of a 5" draw in stainless steel.

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Engineer Shortage Alarms Industry

Ford forum seeking answers to the problem places blame on both industry and educators . . . More students should be lured by glamorizing the profession, high pay and appeal to patriotism—By T. L. Carry.

◆ A DARK SPOT persistently appears in plans the automobile industry has for expansion of its plants and facilities.

The shortage of qualified scientists, engineers and technical personnel plagues industry executives at every turn.

Market analysts can visualize the time when the industry will be producing at an annual rate of 9 million cars per year and the plans they are making to meet the market challenge only help to emphasize the shortage of engineers.

Ford At Disadvantage . . . Among the Big Three, General Motors and Chrysler have their own schools for turning out qualified engineers. Ford Motor Co. has no formal academic program for training engineers and is forced to scratch a little harder in order to obtain the proper help.

But all of the industry is plagued by the shortage. This has

led to the practice of one company hiring help away from another with promises of higher pay and better working conditions. In addition, the industry makes regular visits to college campuses at the end of each semester in an effort to hire all the engineers it can get.

Because Ford is possibly more at a disadvantage than either Chrysler or General Motors, the company has recently been doing some real soul searching on the subject.

What To Do . . . Some 50 educators from leading colleges and universities around the country just attended an Engineering Forum sponsored by Ford. Object of the meeting was to find why there is a shortage of technical personnel and what can be done about it.

As an example of how seriously Ford views the problem, Earle S.

MacPherson, vice president of Ford Engineering, points out that less than 10 years ago the company had 1450 employees on its engineering staff and only 125 of them were engineers. Today, Ford has 10,000 workers on the staff and approximately 30 pct are graduate engineers.

Because of Ford's expansion, the company hopes to have 14,000 workers in the department in a few years. The expanded program calls for Ford to hire 300 engineers for the next 3 to 5 years.

Where are they coming from?

Ernest R. Breech, Ford chairman of the board, deplors the fact that young men today are not encouraged at the primary and secondary school level to take subjects which will qualify them to become engineers.

Blame Is Shared . . . Mr. Breech believes that schools are doing a "very poor job of salesmanship in creating a desire in students to take scientific courses." He also adds that American industry, along with educators, must share part of the blame for the youthful attitude toward scientific subjects.

He believes that a partial solution to the problem would be for both industry and educators to devise a better system of encouraging young people to choose engineering and scientific careers. This, he says, can be done by pointing out the advantages of a high pay scale and the broad scope of fascinating fields that are opening up every day for engineers.

Ford's approach to the problem is also somewhat altruistic, since

Any Color, Even Black

Ford Motor Co. engineers are talking about an electro-magnetic radiation gun that would enable dealers to paint a car merely by squeezing a trigger.

With this technique, all autos would get a coat of neutral white, photo-sensitive pigment at the factory.

The dealer would have only to ask a customer what color he wants, turn a selector switch, line up his sights and squeeze away.

Car washing would be eliminated, too. A car thus painted, passed through an electro-static or supersonic energy field, would emerge much cleaner than is possible with water.

New plastisol compound applies sheet-like coating through spray gun

◆ Unichrome "Super 5300" Coating announced by Metal & Thermit

◆ Durable, corrosion-resistant finish up to 60 mils thick achieved in one coat

Despite the molasses-like consistency of plastisol compounds, they can be sprayed. Several years ago, Metal & Thermit produced the first successful type which permitted 20-mil-thick films per spray coat. New "Super 5300" goes way beyond this—with 60 mils or more per coat.

"Super 5300" Coating gives a thick "sheet" of protection. But since it is sprayed, no seams or joints exist as with conventional sheet materials.

STRONG CORROSION PROTECTION

A compound based on vinyl resins, Unichrome "Super 5300" Coating shrugs off strong acids, caustics, water, salt solutions and other corrosives. Its tough, thick flexible film absorbs impact without chipping, deadens sound, withstands abrasion. Satiny smooth in appearance, it makes an attractive as well as unusually durable finish. It can often permit ordinary metals to be used in place of costly alloys.

"Super 5300" can be used most profitably to line tanks, ducts, pipe and on large, unwieldy equipment or products. It requires uniform baking to cure. If desired, the services of firms specializing in applying Unichrome Plastisols can be used.

This is one of many Unichrome developments in processes and materials which provide opportunities to cut your finishing costs . . . opportunities to turn out a better product through a better finish. We'd welcome the chance to work with you.

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International Products & Manufacturing Company is now specifying "FATIGUE-PROOF" steel bars for generator and starter shafts. These are heavy-duty shafts. Formerly they used 4140 or 8640 heat-treated.

Field failures can be anticipated unless the finest of materials and the best of manufacturing practice are employed.

"FATIGUE-PROOF," by eliminating heat-treatment, does away with any possibility of quench cracked shafts getting past inspection. Since no straightening after heat-treatment is required, unfavorable residual stress due to severe straightening operations cannot be present.

It's another case where "FATIGUE-PROOF's" high strength in-the-bar eliminates a possible cause of trouble.

If you want to improve the quality of your products and avoid the problems of machining or heat-treating parts from high strength carbon or alloy steels . . . try a sample bar of "FATIGUE-PROOF." If you will give us application details, send a blueprint, or call La Salle Sales Engineer at REgent 4-7800, Chicago, Illinois, he will send you a test sample if it appears "FATIGUE-PROOF" can be used to your advantage.

*International Products & Manufacturing Co., of Chicago,
are manufacturers of automotive starter
and generator parts.*

Automotive Production

(U. S. and Canada Combined)

WEEK ENDING	CARS	TRUCKS
JUNE 23, 1956	116,534	24,649
JUNE 16, 1956	110,386	23,300
JUNE 25, 1955	160,335	31,555
JUNE 18, 1955	150,326	28,114

*Estimated. Source: Ward's Reports

Mr. Breech points out that Ford is interested in promoting the advancement of science and engineering generally. He warns that the cold war with Russia is as much a war for the possession of scientific and engineering knowledge as it is a political fight.

More than 50 pct of college students in Russia are pursuing some sort of engineering or scientific courses while the shortage in the United States becomes more acute. Mr. Breech doesn't think that young people in this country should be forced to study engineering but he says there is nothing wrong with pointing out the advantages of a scientific career to young students.

Rambler:

Increasing sales cause marketing changes

The growing popularity of the Rambler has resulted in some major marketing changes at American Motors Corp. for the compact little car.

Roy Abernethy, vice president in charge of marketing and distribution, says that the success of the Rambler this year has made it possible to put the car on its own feet as a separate make.

He points out that the Rambler is one of the two cars with sales exceeding those of a year ago. Approximately 65 pct of AMC sales currently is in the Rambler line.

As a result, at the beginning of the 1957 model year, the designation of the Rambler as either a Nash or a Hudson will be dropped and the car will be marketed simply as a Rambler.

The move has led to speculation that eventually American Motors

will set up separate dealerships for the Rambler in addition to the dealers that are now handling the Hudson and Nash lines.

If such is the case, it will be a long time before such a move actually takes place. The immediate objective of the present changes, according to Mr. Abernethy, is a 6 pct penetration of the low price market.

Right now, Rambler sales are hovering between 2 and 3 pct of the market and it will take a long time before the company even realizes its prime objective.

Layoffs Decrease

Signs continue to indicate that the worst is over as far as auto cut-back are concerned.

Both Ford and General Motors claim that the number of layoffs in the industry have hit their peak and will now steadily decline.

Encouraging reports regarding the decrease in new car stocks have prompted some divisions in both companies to increase their production schedules.

Estimates are that some makes will increase their output by about 3000 units in July and August. It's nothing spectacular but it is an in-

AUTOMOTIVE NEWS

dication that at least the industry is over the hump as far as poor sales and production are concerned.

Latest reports are that all laid off workers will be rehired by the time production starts on the 1957 models.

Continental Birthday

The Continental Div. of Ford Motor Co. completes its first year of production this week and William C. Ford, division general manager, says that production for the period is very close to the 2500 units estimated at the start of the program.

The division produced 2201 cars from June 24, 1955, the first day of production, to May 31 this year.

Mr. Ford says that nothing has happened during the past year to alter the division's concept of a low volume, high quality automobile. Production is still of secondary importance and the division is more convinced than ever that there is a considerable market for the auto.

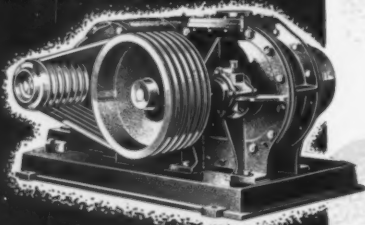
THE BULL OF THE WOODS

By J. R. Williams

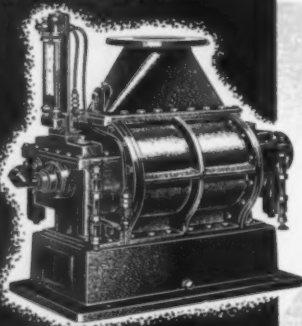




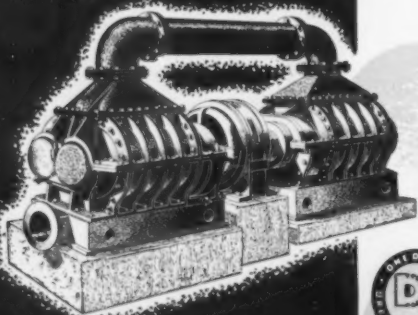
CENTRIFUGAL or Rotary Positive Blowers and Exhausters can move from 5 cfm to 100,000 cfm of air for many diversified needs. For complete details, send for Bulletins 120-B-14, AF-154 and RB-154.



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These are the result of more than 100 years of knowledge and are available to any user of gas or air, or equipment builders who need them. If you have a product or a process which might be improved by our mutual effort, we'll gladly work with you.

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A DIVISION OF DRESSER INDUSTRIES, INC.





THIS WEEK IN WASHINGTON

"Alert" Will Tip Off Emergency Controls

July Civil Defense exercise will show copies of orders which would be used in emergency . . . Extent of "crisis" still undetermined by CD authorities . . . All-out would be serious test—**Ry G. H. Baker.**

♦ **METALWORKING** firms soon will be able to get a first-hand look at the exact provisions of the government orders that will apply in time of war or emergency.

Copies of the actual orders are to be distributed for the first time during the nationwide civil defense "alert" exercises that will be held from July 20 through 26.

As far as metalworking is concerned, the regulations of greatest interest will be concerned with graded priorities for essential production, for allocating scarce materials, and retention of key personnel.

What Kind of Crisis . . . Price control may or may not be invoked in the "alert" exercises. Final decision hasn't been reached yet. It depends upon how big a "crisis" is held.

The government has already prepared orders and regulations for every type and degree of emergency. The strictness or the mildness of the orders to be issued July 20-26 depends upon the type of "crisis" decreed by the war games chiefs. Thus, if the military rules that the nation is in imminent danger of large-scale attack, the orders issued will be the toughest ever . . . essential military production only . . . absolutely no frills . . . severe penalties for chiselers. If, however, the "crisis" is not serious, the orders issued will be very much like the DMS orders that have been in effect since the Korean war.

In order to give bureaucracy a real sweaty workout, many observers predict the war games

chiefs will hold an all-out "crisis," thereby calling up the toughest kind of production and allocation regulations for industry.

More for Defense

A defense-conscious Senate, worried over reports of new Red gains in guided missiles and jet aircraft, is grimly determined to add a whacking \$500 million to \$1 billion in additional funds to the Pentagon's new supply of spending money.

There is little doubt that President Eisenhower's \$35.6 billion defense budget for the fiscal year starting July 1 will be substantially increased. The only question is how much.

A group of Senate Democrats, figuring it has struck political pay dirt in charges that Ike and Defense Secretary Wilson are per-

mitting a "second best air force," are clamoring for an extra \$1.1 billion—chiefly for long-range jet bombers—to be added to the budget.

But most Republicans and some Democrats favor a more moderate increase of \$500 million, also to be earmarked chiefly for building and operating the giant B52 bombers.

Either way, you can expect to find the Pentagon's total spending purse substantially fatter on July 1 than it was a year ago. New and bigger procurement orders, reflecting the increase, will begin to move out of the Pentagon within the next 90 days.

Meanwhile, first supersonic interceptor planes will begin performing U. S. defense missions this summer as the Lockheed F-102A goes on duty. Credited unofficially with a speed of 950 mph

While We Spend More. Others Cut

■ Although heavier spending for U. S. defense is probable, this trend is being reversed in Britain. Planned in London is a new fiscal year cut of \$280 million in government spending, half in defense funds.

■ Reason is a drastic overhaul in Britain's military structure. British defense chiefs reason that guns, tanks, and other conventional weapons are outmoded by nuclear weapons.

■ In re-evaluating defense measures, some of Britain's traditional armament will go, but decisions on manpower commitments have not been made.

■ Red China also will cut defense costs, although not heavily by U. S. Standards. The Chinese Communists will drop their military spending from 22 pct of national budget to about 20 pct. This means a reduction of about \$100 million, to total of \$2.4 billion.



Transmission pinion pin



Locking pin



Bevel gear



Steering arm ball stud



Locking pawl

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that can be
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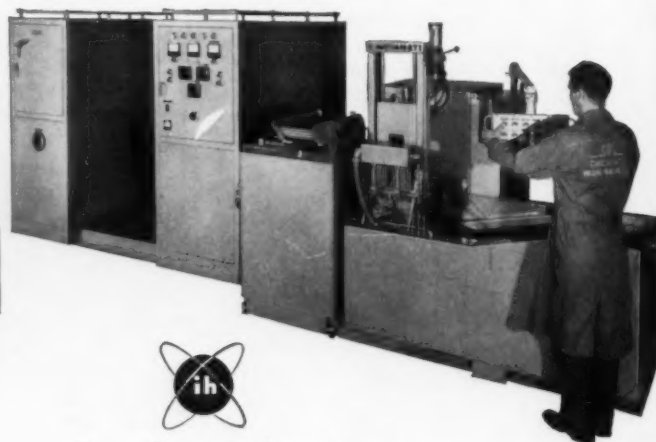


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hardening*

Cincinnati does both — selective flame or induction hardening — and the parts shown above are typical of those that can be hardened by either method. If that's your situation, then talk to Cincinnati . . . headquarters for equipment that gives you the hardness wanted, where it's wanted, using the heat source most economical for you. Use electric power—or acetylene, propane, natural or manufactured gas—whichever is readily available to you or provides lowest cost.

Whether flame or induction, you can be as-



induction

hardening

sured of heat-treating machinery that will deliver the hardness you specify, and meet your cost-per-piece requirements, on high production quantities or varied, small-lot runs. It will be excellently engineered, equipped with the finest of components, thoroughly safeguarded, easily maintained.

Call in a Process Machinery Division field engineer. He is ideally equipped to evaluate your needs and give you unbiased recommendations as to the most economical equipment for your selective surface hardening work.



flamatic induction

hardening machines

THE PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

and a ceiling above 50,000 ft, this aircraft is capable of countering the threat of Russia's best long-range bombers. It will carry aloft the Falcon guided missile and a pair of antibomber rockets.

Distinguishing feature of the F-102A is its "coke bottle" fuselage. Its design permits minimum air resistance and great lift at top altitudes.

Nickel:

Mishandling of Nicaro contracts charged.

Congressional investigators, in a strictly party-line fight, are battling bitterly over whether the government's contract awards to expand its Nicaro (Cuba) nickel plant are on the up and up.

Democratic members of the House Government Operations Subcommittee, which has held extensive hearings on the \$43 million expansion of the Nicaro plant, charge that unnecessary delays in awarding the contracts resulted in loss of at least 10 million lb of critically-needed nickel valued at \$6.5 million.

Other Charges

Other charges include that political and private influence played an active role in awarding construction and insurance contracts; that only one U. S. firm capable of doing the work, the Frederick Snare Corp., was considered by GSA; that conflict of interest is involved in the insurance contract; that the 1951 operating contract with Nickel Processing Corp. is illegal; that the contributions of Merritt-Chapman & Scott as a joint construction subcontractor have been so insignificant that it is not earning its \$500,000 (50 pct) fee, and that fees paid to Nickel Processing Corp. for operating the plant and for research and development are excessive.

In a minority report, the Republican members of the subcommittee have issued a "blanket rejection" of the majority charges, and allege that the Democrats did not

conduct a "proper" investigation, did not call all the witnesses they should have to get the entire story, and did not properly substantiate their findings or recommendations. Failure of the majority to call all the witnesses is "an amazing suppression of evidence," the Republicans contend, adding that the tactics of the majority serve to "belittle the work of Congress."

Both reports say that the subcommittee's investigation of the Nicaro plant expansion will be continued.

Mineral Bill Passes

Legislation to continue through 1958 the government purchase programs for four strategic minerals is expected to stir up some bitter controversy in the House.

Senate lawmakers, after lengthy wrangling, approved the measure, which will commit the government to spending about \$87.2 million in the next 2½ years purchasing tungsten, fluorspar, asbestos, and columbium-tantalum.

Purpose of the measure is to assist the mines producing these metals maintain production while the government works out a long-

WASHINGTON NEWS

term program of help. Opponents of the measure argue that the nation's stockpile of the minerals is now large enough to last five years, even in case of war.

Atomic Exchange

Information on atomic power reactors being developed in the U. S. and Britain for military vessels, planes, and vehicles is to be more fully exchanged under authority of a new agreement signed by the two nations.

Data on nuclear energy activities now is given and received by the U. S. and Britain as a means of preventing duplication in the production of atom-driven devices. This exchange would be broadened as regards the materials used in atomic programs and the status of various military reactors.

The agreement is the first of its kind worked out within the provisions of the current atomic energy law. It is to become effective in mid-July.

Congress Blocks Defense Dept. Coordination

◆ PROPOSALS to achieve better coordination of Defense Dept. research and development activities are running head-on into an old Capitol Hill obstacle—the prerogatives of a congressional committee.

President Eisenhower backs a plan that would add a new assistant secretary for research and development in each of the three major services. This idea is in harmony with recent Hoover Commission recommendations for greater accent on basic scientific studies within the military.

As submitted to Congress, the plan would become effective July 15 unless rejected by either the Senate or House. But Chairman Vinson, D., Ga., of the House

Armed Services Committee, raises an objection.

The Administration request, he contends, should be turned over to his committee, which two years ago approved a bill establishing six more assistant secretaries in the military. As a result, the total of secretaries, deputies, and assistants at the Pentagon was raised to 29.

Mr. Vinson has offered a resolution to block the request and thinks he will get House endorsement. Also, he will testify before the House Government Operations Committee on the plan. Unless he is assured his views will get careful consideration, his appearance may lead to a serious scrap over handling of the plan.

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New
DUO-SIZE
End
Mills...**

*two
different
sizes
in
one*

Here's money-saving news for toolrooms and job shops! Now you can cover the size range of 14 regular end mills, using only 7 new, exclusive Brown & Sharpe Duo-Size End Mills. Each Duo-Size Mill has ends of different diameters . . . cuts your toolroom costs. Duo-Size End Mills give you *all* the advantages of other Brown & Sharpe End Mills.

And, with each complete set of 7 sizes, you get a sturdy wooden holder, for your convenience.



Duo-Size End Mills are available in ranges of 7 mills each, right-hand, from 3/32" to 1" with either two or four flutes, 30° helix. For complete details, write Brown & Sharpe Mfg. Co., Providence 1, R. I.

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Farwest Will Increase Pacific Trade

West Coast's trading advantages are important factor in stepping up exports to develop Pacific Basin nations . . . Shorter distances involved, savings in transit time work in its favor—By R. R. Kay.

♦ **ONE BILLION PEOPLE** live in the Pacific basin countries. As world trade expands, a good part of the growth must come from them and that's where the West Coast gets a bigger foot in the door.

The vast economic and industrial growth of this region puts the nation's product thousands of miles closer to the huge world trade potential of the Pacific area. The great industrial base we now have on the West Coast can revolutionize the scope of our Pacific trade.

It's a Natural . . . Savings in transit time, shorter distances involved, and greater ease of communication between the other Pacific areas and the West Coast gives this part of the country a tremendous advantage in foreign trade competition. So says Louis S. Rothschild, under secretary of commerce for transportation.

Lands adjoining the Pacific trade routes will especially benefit from factors now working to encourage world trade. For the Pacific nations are on the march to develop their industry.

Trader's Paradise . . . In the Pacific are the new pioneering nations of Asia: Korea, Indonesia and the Philippines. Also the older trading nations and, of course, Australia and New Zealand in the South Pacific. The West Coast of South America is sure to grow economically. Trade with Western Canada, Hawaii, and Alaska is bound to build up.

"All of these people have mate-

rials which we can use in our expanding economy. They need vast quantities of the products of our industry, both for consumer use and for the industrial development of their lands," Mr. Rothschild believes.

Coast Briefs

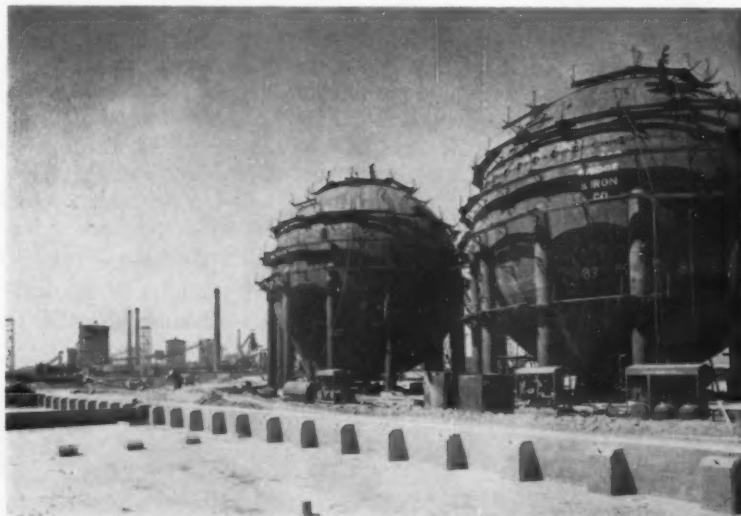
Chief Joseph Dam, one of the world's largest hydroelectric plants, has been dedicated. The \$160 million plant, downstream from the mighty Grand Coulee Dam, will eventually produce 1.7 million kw for power-hungry Pacific Northwest use.

There'll be more kilowatts, too, for the Seattle industrial area. Work crews are now clearing the site of the Upper Baker River Dam in Skagit County. A power plant

there will provide 85,000 kw. In addition, 55,000 kw more will come from the Puget Sound Power and Light Co.'s Lower Baker plant. Cost of the latter two: \$35 million.

A peek into the future by a man who ought to know, Hall L. Hibbard, Lockheed Aircraft's engineering vice president, brings three predictions: commercial airliners traveling at supersonic speeds . . . mail rockets for "missile mail" . . . freight rockets for premium express that will speed across the nation in a matter of minutes.

Scheduled layoffs at the Puget Sound Naval Shipyard at Bremerton, Wash., have been cancelled, states Rear Adm. A. G. Mumma, chief of the Navy's Bureau of Ships.



TWO GIANT spheres nearing completion at U. S. Steel's Geneva Works, Provo, Utah, are part of first chemical plant ever constructed by a major steel company in the U. S. The plant will produce anhydrous ammonia.

Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal



Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.



Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.



Only a No. 8 MARVEL can do all of these things: Snip-off a 1/4" rod or cut-off an 18" x 18" cross section



Rough to Size and Shape



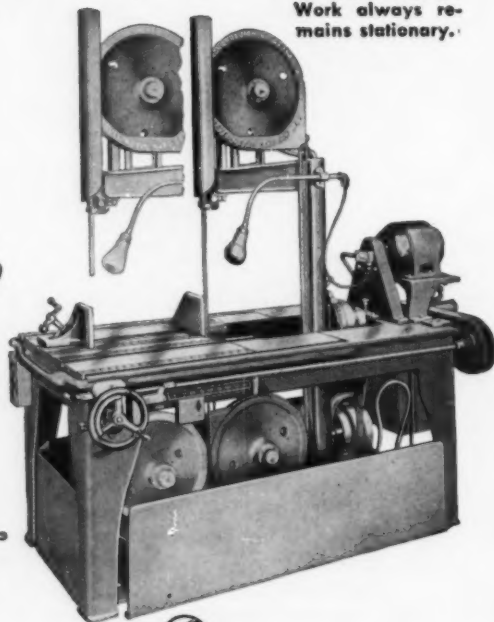
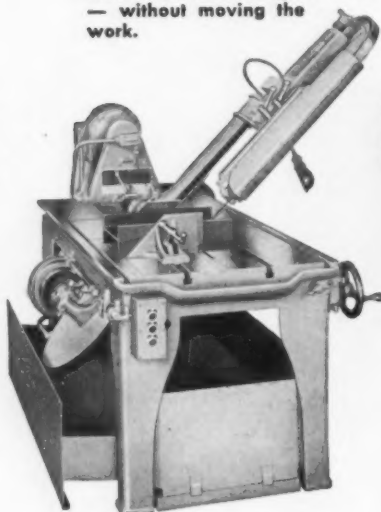
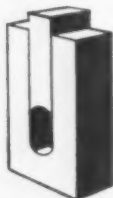
Miter



Index



cut off and shape Structural Beams.



Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

"Rough Machine" to size and shape with minimum chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.



ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.



Tape Control Simplifies Machining

Automatic control setup featured in English exhibition indicates such units don't need to be expensive or complex . . . Specialized training of operating personnel is not a requirement—By E. J. Egan, Jr.

♦ A COMPLETELY automatic, tape-controlled machining system, reported to be operable by relatively unskilled personnel, is certain to be a highlight of the current International Machine Tool Exhibition at London, England.

Control system, due to go into service this year, is a development of Acoustical Mfg. Co., Ltd., Huntingdon, England. Firm's display at the Exhibition features a milling machine automatically producing three dimensional parts from the solid. Magnetic tape for the control unit is prepared by a special digital computer.

Needs No Jigs . . . Several interesting claims are made for this control setup. One is that simple or complex parts of any size can be machined to any degree of accuracy without the use of jigs, models or cams. Another is that although the system's digital measuring device is simple and entirely free from mechanical wear, it can match the capabilities of the most precise machine tool.

Setup is said to be applicable either for continuous control of cutting tool position, as in turning or milling, or where only coordinate positioning is required. Another claim: system can be incorporated in many existing types of machine tools.

Firm also has an answer for the common complaint that most tape control systems are expensive and so complex that they must be operated and maintained by skilled technicians. It is claimed this entire setup, including tape prep-

aration, can be operated by personnel who have not had specialized training.

If the control technique is as simple and flexible as claimed, it could bring significant practical and economic advantages to many problem machining areas.

Do-It-Yourself . . . A plan by which manufacturers can build up their own special machine tools for mass production of small metal parts and assemblies is offered by The Bodine Corp., Bridgeport, Conn. Firm has long been a producer of automatic dial type machines for machining and assembling small to medium sized metal and plastic parts.



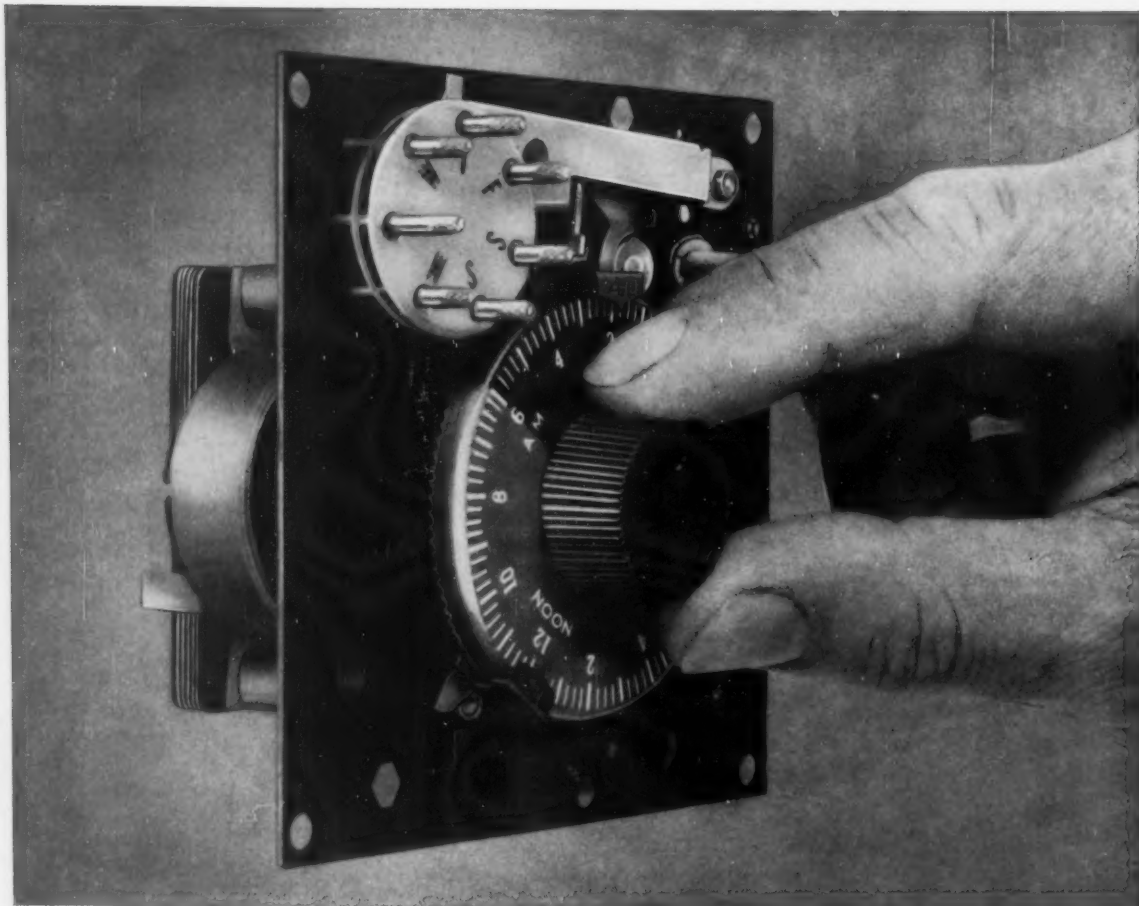
"Smellnik, you're taking this job of safety director too seriously!"

Typical work cycles on these multi-station, multi-spindle machines might include drilling, reaming, tapping, milling, screw inserting and a variety of assembly operations. Idea is that the customer can now buy a stripped-down chassis of the basic machine in any of four sizes and tool it himself with standard indexing, feed and spindle units made by Bodine.

Quickly Applied . . . Claim is that these matched tooling units can be applied to the basic chassis quickly and economically. Savings in setting up one special machine to do a variety of work are said to be considerable in contrast to buying separate indexing tables, feed mechanisms and other components.

All operations on machines offered on this do-it-yourself plan are mechanically interlocked. This eliminates the need for air feeds and electrical interlocks. Repair or replacement parts for these customer-built machines will be standard, inspected items.

Talent Call . . . Speakers Bureau of the National Machine Tool Builders' Assn. is recruiting additional talent to tell the "average man" how machine tools contribute to the nation's high standard of living. First call for new voices produced volunteers from 25 builders. Service clubs, schools, business and civic groups interested in hearing the machine tool story should write NMTBA, 2071 E. 102nd St., Cleveland.



Telechron Timer for household use

When your product must remember ... use **COPPER**

Copper helps you add memory to mechanisms.

So modern industry uses copper to *remind*.

The electric timer . . . an integral part of automation. The automatic washer . . . with its cycle of changes. The clock radio . . . and its "wake up" program. The parking meter . . . warning the motorist when "time's up!"

Even in the kitchen, copper in the cooking-

timer helps boil the eggs just 3 minutes.

In all such applications, copper and copper-base alloys offer you *many* advantages. Smooth operation . . . miniaturization . . . corrosion resistance . . . ready formability . . . close tolerances . . . easy joining . . . beautiful plating and polishing.

And even when hidden from view in a complicated mechanism, copper goes right on doing the work you have given it to do!

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Easy to machine,
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polish, plate, etc.

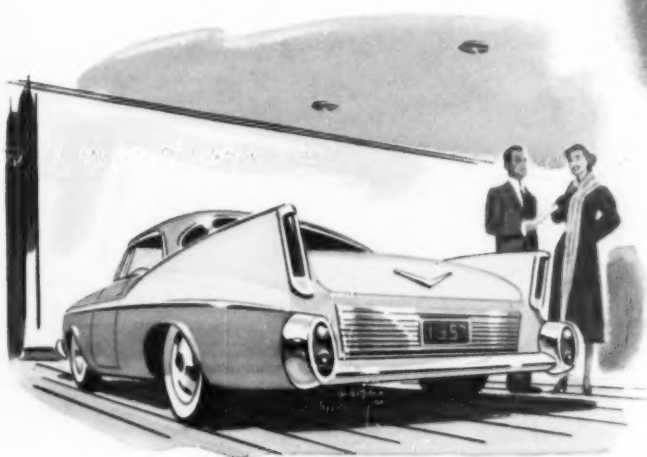


Welds readily . . .
excellent for
soldering and brazing



in automobiles everybody benefits from Stainless Steel

THE MANUFACTURER styles your car with Stainless Steel because it's the readily workable, long lasting metal with beauty and sales appeal.



THE DEALER is proud and confident to offer a product made with Stainless Steel. He knows that nothing compares with Stainless for durability and customer satisfaction.



THE PURCHASER from long experience recognizes Stainless Steel as the easy to clean metal that keeps its shape and good looks under the toughest conditions of driving and weather. Also it's a big plus at trade-in time.

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FOR THE PRODUCT YOU MAKE TODAY AND THE PRODUCT YOU PLAN FOR
TOMORROW SPECIFY McLOUTH HIGH QUALITY SHEET AND STRIP STAINLESS STEEL



McLOUTH STEEL CORPORATION DETROIT, MICHIGAN • MANUFACTURERS OF STAINLESS AND CARBON STEELS

(Advertisement)

SPECIAL REPORTS ON FINISHING NON-FERROUS METALS

NUMBER III—Lustrous, Corrosion-Resistant Finishing with Chemical Polishing Iridite

WHAT IS IRIDITE?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

Chromate conversion coatings are widely accepted throughout industry as an economical means of providing corrosion protection, a good base for paint and decorative finishes for non-ferrous metals. Certain of these coatings also possess chemical polishing abilities that have luster-producing, as well as corrosion-inhibiting, effects on zinc and cadmium plate, zinc die castings and copper alloys. However, continued developments in this field have been so rapid that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this discussion of the many ways in which this chemical polishing characteristic can be used in final finishing or pre-plating treatments to produce a lustrous appearance with distinct display and sales appeal and appreciable savings in cost. Report I on decorative, corrosion-resistant finishes and Report II on paint base corrosion-resistant finishes are available on request.

The degree of luster possible on a surface is a function of the degree to which the surface can be smoothed. Leveling to provide a smooth surface can be achieved by mechanical or chemical means, or a combination of these, depending upon the luster desired and the original condition of the metal. Chemical polishing effectively imparts luster otherwise difficult and costly to obtain. For this reason, it is often used to supplement or entirely replace mechanical polishing, depending upon the application and the original condition of the metal. Chemical polishing has the additional advantage of providing overall treatment of the submerged part. It reaches into even the deepest corners and recesses that are otherwise inaccessible. Certain of the Iridites are specifically designed to perform this chemical polishing operation. Also, they provide corrosion protection as do all Iridites, thus may be used as a final finish or a pre-plating polish.

If Iridite is to be used as a final finish, in contrast to pre-plating treatment, the chromate conversion coating generated is allowed to remain, providing good corrosion resistance. Color inherent in these Iridite films ranges from a yellow cast to yellow iridescent. These coatings may be used without further treatment where this color is acceptable and good corrosion resistance is desired. Further, these basic coatings can be tinted by dyeing. Among the dye tints available are shades of red, yellow, blue and green. If desirable, the basic coatings can also be modified by a bleach dip leaving a clear bright or blue iridescent finish. In all cases bleaching reduces corrosion resistance.

As examples of this type of final finishing, Iridites #4-73 and #4-75 (Cast-Zinc-Brite) make possible for the first time, lustrous chemical polishing of the as-cast surface of zinc die castings. Thus, in many cases, sizeable savings in finishing cost are realized by elimination of plating costs. This economical method can be used on tools, appliance parts, toy pistols, locks and many other small castings. Another example is the treatment of copper and brass parts, such as welding tips, to eliminate buffing and provide additional corrosion resistance. In many cases, handling costs are reduced appreciably by replacing piece-part handling with bulk processing. Still another example of the use of this chemical polishing and protective quality of Iridite is a simple system of zinc plate, Iridite and clear lacquer instead of more costly electroplated finishes. Typical of this type of lustrous finish are builders hardware and wire goods.

As a pre-plating treatment, in contrast to final finishes, Iridite can be used to chemically polish zinc die castings or copper prior to plating. In such cases, Iridite should be applied as an in-process step, so that the protective film is removed before the plating cycle. The savings in hand-

ling, material and labor costs are obvious. This process has made it practical to plate chrome directly over copper on steel, conserving nickel, yet producing a lustrous chrome finish. Used after stripping faulty plate in reprocessing zinc die castings, Iridite restores luster to the casting, thus making possible replating without blistering.

Other Iridite finishes are available to produce maximum corrosion resistance, a wide variety of decorative finishes and excellent bases for paint on all commercial forms of the more commonly used non-ferrous metals. As a final finish, appearance ranges from clear bright to olive drab and brown and many films can be bleached or dyed. As a paint base Iridite provides excellent initial and retentive paint adhesion and a self-healing property which protects bare metal if exposed by scratching. Iridites have low electrical resistance. Some can be soldered and welded. The Iridite film itself does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of their top performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product demands the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.



The Iron Age

SALUTES

Ralph E. Cross

An expert on automation, he is continually sought by industry and government agencies for advice . . . As executive vice president of The Cross Co., his contributions to the metalworking field are invaluable.

When U. S. government officials talk of automation, they automatically turn to Ralph E. Cross, executive vice president of The Cross Co., for guidance. As an expert in the field, Mr. Cross has taken a lot of time from administrative duties in private industry to lend a helping hand to Uncle Sam. He feels that automation needs plenty of explaining—its aims, methods and engineering principles—and that he should do his part in educating the public.

The government frequently takes advantage of his willing nature. He served as assistant administrator of the Department of Commerce, Business and Defense Service Administration, director of the metalworking division and technical adviser for the U. S. during overseas conferences on strategic materials.

Ralph Cross probably would wince if he were pictured as a "hard hitting executive," yet that phrase aptly describes him. Business and engineering activities dominate his day. His contributions to the fields of automation and metal-

working are numerous. The Chicago A.S.T.E. presented him with its Engineering Citation for distinguished development of engineering principles.

It is more than just fortunate for the industry that Ralph Cross was the son of Milton O. Cross, founder of The Cross Co. His father provided a sound adjunct to Ralph's formal education at Massachusetts Institute of Technology. His brother, Milton O. Cross, Jr., president of the firm, also has contributed much to Ralph's development.

Despite his busy schedule, he manages to devote time to his wife, Eloise, and their three children. His home, near Lake St. Clair, Mich., offers ready access to his favorite hobby—boating. For a man who is engrossed in automation, one might expect to find Ralph Cross wheeling the latest model power boat—equipped with special gadgets—around the lake. But no, he prefers a more primitive craft equipped with just a mast, a sail and a rudder.

Speeds materials handling 30% to 40%

...on TIMKEN® bearings

THIS Towmotor Model 460, known as "The One-Man Gang" in the automotive industry where every minute counts in meeting tight production schedules, cuts materials handling time up to 40%. And Timken® tapered roller bearings "roll the load" in steering kingpin, steering wheel, drive wheel, jack shaft, differential gear shaft and pinion—keep the Model 460 on the go.

Highly maneuverable, the Towmotor 460 must make countless starts and stops—putting heavy load on the pinion. Timken bearings keep the gears in accurate alignment despite these heavy changing loads. The tapered construction of Timken bearings lets them take radial and thrust

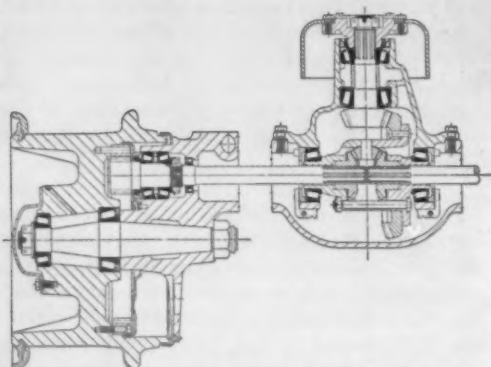
loads in any combination. And full line contact between Timken bearing rollers and races gives them extra load-carrying capacity. No extra thrust devices are needed. Simpler, more trouble-free designs are possible.

Maintenance costs are reduced, with Timken bearings practically eliminating friction. Geometrically designed and precision-manufactured to give *true rolling motion*, Timken bearings meet rigid quality controls every step of the way. We even make our own steel, which no other American bearing maker does. Timken bearings make all kinds of machinery run better, last longer. Look for the trade-mark "Timken"

on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



This symbol on a product means its bearings are the best.



TOWMOTOR CORPORATION mounts the drive axle of its Model 460 lift truck on Timken tapered roller bearings to speed materials handling.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

ROLL THE LOAD

The Iron Age INTRODUCES

J. B. Nordholt, Jr., elected president, **Webster Manufacturing, Inc.**, Tiffin, O.; **C. S. Jones**, elected vice president, engineering; **J. S. Nordholt**, elected vice president, manufacturing; **Harry E. Byrne**, elected secretary-treasurer.

Chad W. McMills, elected ass't to vice president, sales, **Columbia-Geneva Div., U. S. Steel Corp.**, San Francisco.

William H. Kinney, appointed ass't to vice president, operations, **Kaiser Steel Corp.**, Oakland, Calif.

Marlin C. Hinds, named ass't secretary-treasurer and purchasing agent, **Connors Steel Div., The H. K. Porter Co., Inc.**

Robert O. Miller, named manager, sales, **The Korhmel Steel & Aluminum Corp.**, Wisconsin.

Bruce M. Sheffer, appointed manager, manufacturing engineering, **Carboloy Dept., General Electric Co.**, Detroit.

Theodore Gupton, named district manager, **Houston, Alco Products, Inc.**

Robert Ramsbotham, named chief engineer, **Fabricating Div., Plume & Atwood Mfg. Co.**, Thomaston, Conn.

Charles E. Gearing, named sales representative, **Birmingham district office, Allis-Chalmers Industries Group**, Milwaukee.

O. C. Kebernick, appointed administrative ass't to manager, commercial atomic power activities, **Westinghouse Electric Corp.**, Pittsburgh.

W. M. Olson, appointed ass't to general credit manager, **Kaiser Aluminum & Chemical Sales, Inc.**, Chicago; **W. E. Kirkwood**, appointed division credit manager, **Cleveland**.

Paul E. Christman, named turbine specialist, **Pacific Southwest district, General Electric Co.**, Los Angeles, Calif.

Chauncey A. Mitchell, named superintendent, manufacturing services, **Alco Products, Inc.**, Latrobe, Pa., plant; **Charles R. Funk**, appointed to metallurgy post.

A. James Fisher, appointed general sales manager, **Metal & Thermit Corp.**

John W. Pike, appointed Eastern district manager, **Struthers Wells Corp.**, Titusville and Warren, Pa.

John P. Cartwright, named sales manager, **Industrial Sales, Joy Manufacturing Co.**, Pittsburgh; **Arnott J. Lee**, appointed Washington district manager.

Donald E. Moat, named director, marketing, **Leeds & Northrup Co.**, Philadelphia; **G. Lupton Broomell, Jr.**, named ass't director of engineering and acting head, **Engineering and Inspection Depts.**

PERSONNEL



GEORGE E. SHAFER, appointed vice president, engineering, **Armco Drainage & Metal Products, Inc.**, Middletown, O.



A. H. DALL, elected vice president, **Cincinnati Milling and Grinding Machines, Inc.**



CHARLES M. REESEY, elected vice president, **Cincinnati Milling & Grinding Machines, Inc.**



S. J. MORAN, elected vice president and general manager, **Foundry and Mill Machinery Operations, Blaw-Knox Co.**, Pittsburgh.

Allen R. Bacon, named resident manager, construction, aluminum plants, **Kaiser Aluminum & Chemical Corp.**, Ravenswood, W. Va.

J. Earl Romer, named manager, Eastern sales, **Bliss & Laughlin, Inc.**

Gunar Moe, named district manager, New York office, **Century Electric Co.**, St. Louis.

Robert P. Marks, named field sales representative, **The Allen Mfg. Co.**, Hartford, Conn.

Roy W. Wiley, appointed representative, Chicago and Northern Illinois, **Bruce Products Corp.**, Howell, Mich.

Paul J. Wolfert, appointed supervisor, export sales, **Blaw-Knox Co.**, Pittsburgh.

Reed D. Holt, named sales representative, National Alloy Div., **Blaw-Knox Co.**, Blawnox, Pa.

Alfred F. H. Bischoff, named manager, Coolidge Lab. X-Ray Dept., **General Electric Co.**, Milwaukee.

William L. Martin, named sales manager, **Potter & Johnson Co.**, Pawtucket, R. I.

Harry T. McKay, named management sales representative, **Westinghouse Electric Corp.**, Chicago; **Gordon M. Bartage**, named area manager.

Charles L. Swinden and **Willard J. Hannon**, appointed sales representatives, **Leschen Wire Rope Div.**, **H. K. Porter Co. Inc.**, St. Louis, Mo.

William Clyde Forsyth, named chief engineer, **The William B. Pollock Co.**, Youngstown, O.; **William Charles Kroeger**, named ass't chief engineer.

Charles G. Rigdon, appointed barrel finishing engineer, **Frederic B. Stevens, Inc.**, Detroit.



E. C. ROOK, elected vice president, and general manager, **Fabricated Products Operations, Blaw-Knox Co.**, Pittsburgh.



J. H. ELLIOTT, named ass't executive vice president, operations, **U. S. Steel Corp.**, Pittsburgh.



E. H. GOTT, elected vice president, operations-steel, **U. S. Steel Corp.**, Pittsburgh.



HARVEY J. HAUGHTON, elected controller, **Jones & Laughlin Steel Corp.**, Pittsburgh.

COWLES SLITTING KNIVES

Cut costs 3 ways

Cowles knives reduce set-up time. They are made so accurately they can be assembled on the arbor without shimming. Cowles knives stay on the job longer;—they reduce down-time for re-grinding; and produce straight edged strip with minimum burr avoiding tie-ups in blanking operations.

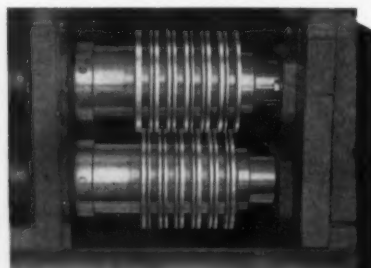
For maximum economy and satisfaction order your knives and spacers from Cowles, world's largest manufacturer of rotary slitting knives. Prompt delivery. Complete range of sizes and analyses for slitting high and low carbon steels, stainless, alloys, silicon or non-ferrous metals.

Engineering Assistance On Any Slitting Job!

COWLES TOOL CO. 2086 WEST 110th STREET
CLEVELAND 2, OHIO

Specializing in the Manufacture of

ROTARY SLITTING KNIVES • SPACING COLLARS • GANG TOOLS • EDGING ROLLS
• CUT-OFF KNIVES • SEAM GUIDE ROLL FINIS • SEAM GUIDES • WIRE DRAWING
TOOLS • STANDARD AND SPECIALLY ENGINEERED TOOLS FOR ALL FERROUS
AND NON-FERROUS PROCESSING, TRIMMING AND FORMING REQUIREMENTS.





GRANITE CITY STEEL
GRANITE CITY, ILLINOIS

Granite City saves fuel, raises production and quality with Cities Service Heat Prover!

Nation's 14th largest steel producer uses Heat Prover on soaking pits, open hearth furnaces and on their annealing furnaces.

Granite City Steel burns enough fuel in one year to heat a five-room house for 38,000 years!

Obviously, if this fuel burns inefficiently, the loss could be staggering. But Granite City has no worries on that score. "Thanks to the portable Cities Service Heat Prover, we get better fuel efficiency, better quality, greater production than ever," they report.

"Because it provides a quick, highly accurate check of fuel-air ratio, the Heat Prover has proved invaluable in controlling combustion conditions in open

hearth furnaces, soaking pits, and annealing and normalizing furnaces. In a matter of seconds it tells our engineers how efficiently the furnaces are working—whereas former tests often took hours and didn't provide as accurate a picture. Anyone in this business can probably benefit from this ingenious device."

Supplied and maintained free by Cities Service, the remarkable Heat Prover is today used and applauded by scores of major steel producers. If you'd like to learn how it could simplify your operation as it has theirs, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



20TH CENTURY BLOWGUN—a bazooka—is readied by technicians for tapping open hearths. They are part of Granite City's 4800 skilled employees.

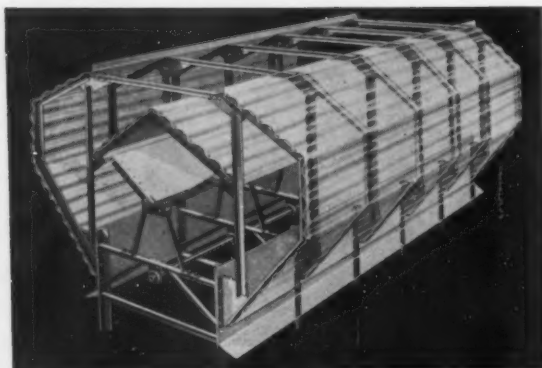


HEAT PROVER AT WORK at back of open hearth furnace. In minutes it provides accurate check on furnace efficiency—saves hours required by former testing.

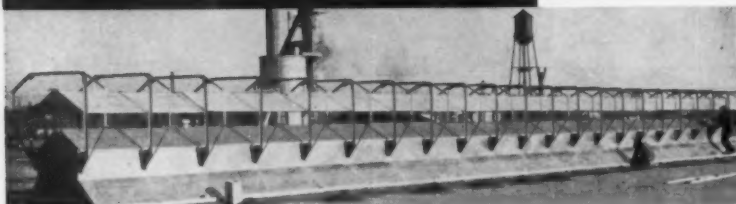


CONTROL TOWER at blooming mill guides ingots as they pass through rollers. Granite City has capacity of 1,200,000 net tons of ingots annually.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS



TOP—The Burt Monovent Ventilator. Sizes to 96" throat—continuous runs, as required.
BELOW—Burt Monovent on The S. K. Wellman Co. plant during erection by Industrial Roofing & Sheet Metal, Inc., Cleveland. Contractor—Albert M. Higley Co., Cleveland. Engineer—Vincent Eaton, Cleveland. Architect—Charles Bacon Rowley & Associates, Inc., Cleveland.



110 FOOT BURT MONOVENT EXHAUSTS HEAT AND SMOKE from the S. K. WELLMAN COMPANY ADDITION

The S. K. Wellman Company's new 120' x 240' addition to their Bedford, Ohio, plant required highly efficient ventilation to remove smoke and heat from metallurgical processing equipment. The solution—this 110' Burt Monovent Continuous Ridge Aluminum Ventilator, with 72" roof opening quickly exhausts hot, stagnant air uniformly along the entire building. Center hinge butterfly type dampers and the fixed top form a cone-shaped airflow section that provides broad, simple air flow lines, eliminating numerous air passes and attendant friction losses. The Burt Monovent is economical to install, operate and maintain and highly efficient.



Send for FREE Data Book!

Write for Burt Data Book SPV-101-E. It supplies quick data on Burt's complete line of modern Roof Ventilators.

FAN & GRAVITY VENTILATORS • LOUVERS • SHEET METAL SPECIALTIES

The Burt Manufacturing Company

920 So. High St.

Akron II, Ohio

MEMBER POWER FAN MANUFACTURERS ASSOCIATION

PERSONNEL

C. M. O'Donnell, ass't manager, Grating Dept., Blaw-Knox Co., Pittsburgh.

Robert Skinner, named process engineer, Frit Div., Ferro Corp., Cleveland; Rudy Foster, named factory superintendent, Frit Plant.

William R. Dickinson, appointed resident representative, Rheem Manufacturing Co., Chicago; R. L. Worrell, appointed sales representative.

Richard L. Burt, named works auditor, South Works, U. S. Steel Corp.; James J. Riley, named works auditor, Homestead district works.

Harry E. Mitchell, named carbide tool sales representative, Midwestern district, Carboloy Dept., General Electric Co., Detroit.

Ralph Armentrout, appointed to metallurgical staff, Tubular Products Div., The Babcock & Wilcox Co., Milwaukee Plant.

Edward J. Doolittle, named field sales engineer, Loewy-Hydropress Div., Baldwin - Lima - Hamilton, Cleveland.

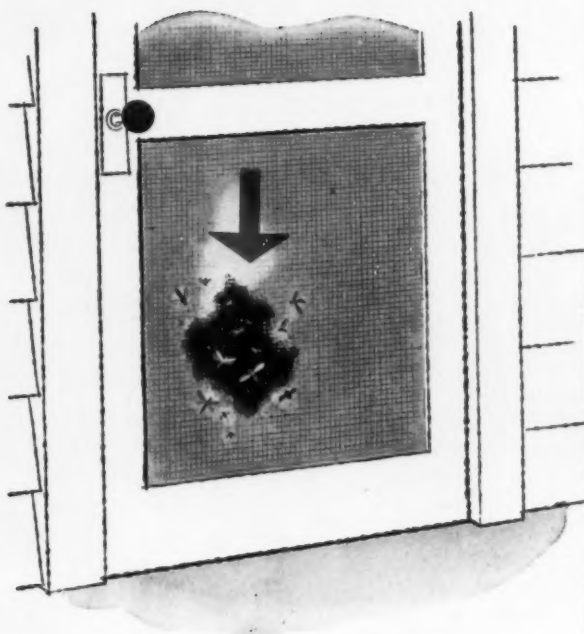
Frank A. Thorn, appointed labor relations administrator, Carboloy Dept., General Electric Co., Detroit.

Frank L. Hodges, named salesman, Standard Pressed Steel Co., Jenkintown, Pa.

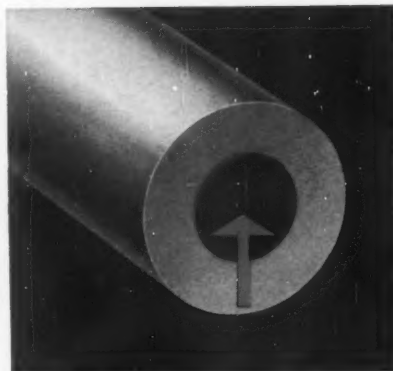
Bernard C. Dunn, appointed sales engineer, milling machines, Axelson Div., U. S. Industries, Inc., Los Angeles.

William C. Meyer, named purchasing agent, Pittsburgh Div., Westinghouse Electric Corp.; C. W. Ellingson, Jr., appointed director, purchases, Apparatus Group.

W. Y. Humphreys, named Pittsburgh district manager, Sturtevant Div., Westinghouse Electric Corp., Pittsburgh.



a hole here is a nuisance...



a hole here is convenient

Crucible Hollow Tool Steels eliminate the nuisance of drilling, boring, cutting-off or rough-facing of ring-shaped, tubular or bored tool steel parts. They save you money, too, by reducing machine time and scrap losses.

Crucible Hollow Tool Steels are produced in all of the famous Crucible tool steel grades . . . in bars or saw cut lengths to meet your needs. And they're available in almost any combination of O.D. and I.D. sizes. You can get these five grades "off the shelf" from your local Crucible warehouse: KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot work.

See how Crucible Hollow Tool Steel Bars will save you hours of shop time. Call your Crucible representative. *Crucible Steel Company of America, The Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

A YEAR AGO
nobody believed it!



GOULD & EBERHARDT
21" SHAPER
installed (without
cement, bolts or
screws) on AIR-LOC
pads that prevent
machine from "walk-
ing".

Now, over 3,000 presses, lathes,
etc. are
installed
on

Air-Loc
®
4-17-4

AIR-LOC is the *only* machinery
mounting method that gives you
all these advantages:

- You just sit the machine on AIR-LOC.
- You don't need cement, bolts or other fastening devices.
- You reduce transmitted machine noise and vibration up to 84%.
- You start machine right away—no waiting for cement to dry.
- You can re-use AIR-LOC because it is not cemented, does not "pad down".
- You can mount up to 72 tons per sq. ft. on AIR-LOC with absolute safety.

Every order shipped
same day received.

FREE BOOK TELLS ALL

AIR-LOC Division
Clark, Cutler, McDermott Co.
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Please send the booklet
describing patented AIR-LOC to:

NAME (PLEASE PRINT) _____
COMPANY _____
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TECHNICAL BRIEFS

TESTING: Wire Products

Fatigue laboratory is torture chamber for springs, wire rope, cables . . . Vibration machines simulate wind action to vibrate cable at one to 20,000 cycles per second.

How much bounce in a spring?

To answer this question and to provide for customers a more accurate evaluation of other wire products, U. S. Steel's American Steel and Wire Div. has established at its Cuyahoga Works in Cleveland, Ohio, the only laboratory in the corporation devoted exclusively to fatigue testing.

Fatigue testing is simply determining the life span and endurance limits of steel products. To this end, the Cleveland laboratory is one big torture chamber for springs, cables, wire rope, conductors and other products made of wire.

Helical Springs Tested

For testing helical springs such as automobile valve and front suspension springs, springs for beds, machine guns, railroad cars and for refrigerator compressors, the laboratory is equipped with 4 variable stroke compression machines, one of which is able to test springs made of 3/4 in. diam wire and having a compression up to 7500 lb. This machine tests two springs at a time and has a variable speed up to 1500 cycles per minute.

In a high wind, transmission cables will "sing" as they vibrate. This vibration of the cable causes it to flex rapidly at all points of support. As these cables are installed for decades of service, the wire must be designed to withstand this flexing action. The laboratory has two vibration machines to simulate, through electromagnetic drive, the action of wind vibration from 1 cycle to 20,000 cycles per second.

Spring Evaluation

Two torsion spring testers are provided to evaluate springs such as are used in overhead garage

WANT MORE DATA?

You may secure additional information on any item briefed in this section by using the reply card on page 153. Just indicate the page on which it appears. Be sure to note exactly the information wanted.

doors, wind-up toys and various other spring-powered equipment. These machines can cycle each spring through any range suitable to determine its life expectancy and load-carrying capacity.

Of the laboratory's two tensile-



Machine tortures springs at up to 1500 cycles per minute.

strength machines, one is unusual. It is horizontal instead of vertical and can take up to 20 ft of sample cables. It has a maximum capacity of 60,000 lb pull.

There are four reverse-bending machines for testing wire from 1/4 in. diam down to 0.004 in. The wire to be tested is mounted in a curve and then rotated at speeds up to 20,000 rpm.

TECHNICAL BRIEFS

Diecasting:

**Multiple parts are cast
in single operation**

A new tool utilizes 14 specially designed zinc die castings that are die cast on one gate simultaneously. Manufactured by a Chicago firm, a single die trims them in another operation.

Presently used in the manufacturing of power garden tools at the W. R. Brown Co., the only machining steps required are drilling four No. 6-32 holes in the gear head castings and a 11/16 in. hole in the saddle bracket for the drive shaft tube. Holes are tapped for assembling the saddle bracket to the drive shaft tube, handle and drill brackets.

Zinc Die Castings

The drive shaft tube is welded steel tubing, zinc plated; the hoe blades are zinc plated spring steel. All 14 cast parts are zinc die castings, not zinc plated spring steel as incorrectly reported recently in these columns.

Die-cast parts consist of a two-part gear head, two oil seals, two hexagonal drivers with attachment keys, four blade spacers, two outer washers, a saddle bracket and a drive shaft coupling.

Casting design problems required careful consideration of cores and drafts that would need machining. Simple to cast parts that required a minimum of machining were emphasized.

Shrinkage Compensation

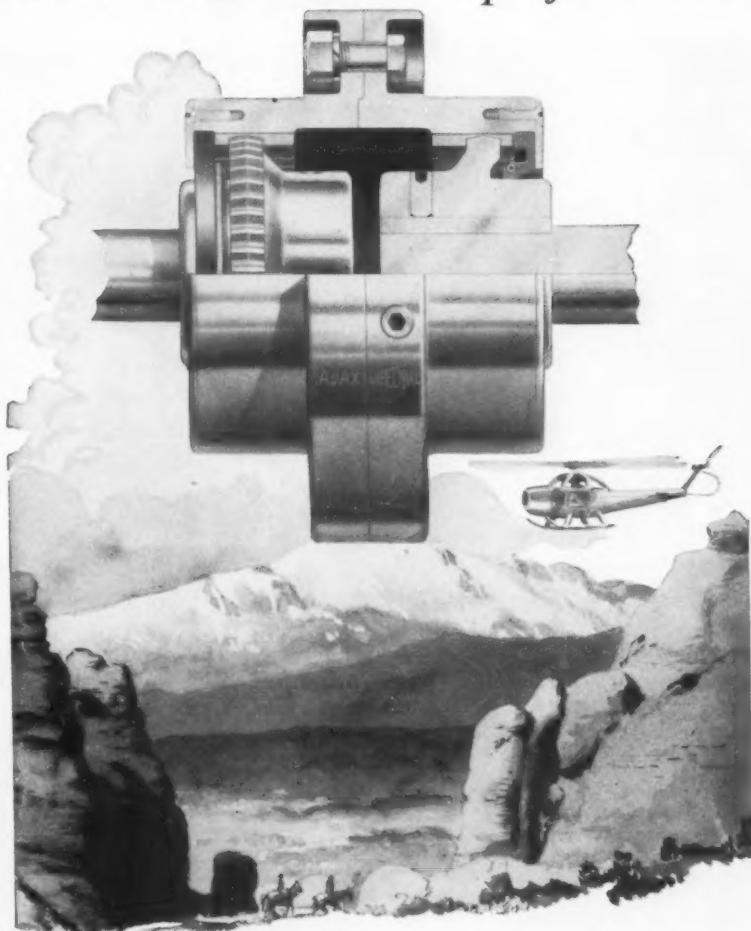
Compensating for shrinkage, the designer was able to hold dimensions to within 0.001 and dispense with drilling. Only secondary operation needed was a single ream to remove necessary draft, and the tapping of the threaded holes.

Zinc was chosen for its casting ease, machineability, dimensional stability and inherent capacity to withstand the hard usage generally encountered in abrasive soils, company says. Manufacturer's experience indicates that zinc parts require no protective coating for normal use other than a mild passivating before painting.



DIHEDRAL COUPLINGS

*reach a new **PEAK** in performance*



► The shortest distance between two points is via Ajax equipped helicopter. On September 13, 1955, a Cessna Helicopter driven by a Continental 260 H. P. power plant settled to a landing on the summit of Pikes Peak!

An Ajax Dihedral Floating Shaft Coupling delivered the power and handled the misalignment between motor and vertical drive unit.

This is one more dramatic performance test of Ajax Dihedral Couplings.

They are handling alignment and misalignment problems on difficult installations including steel mills, cranes, oil drilling rigs and a host of other severe installations.

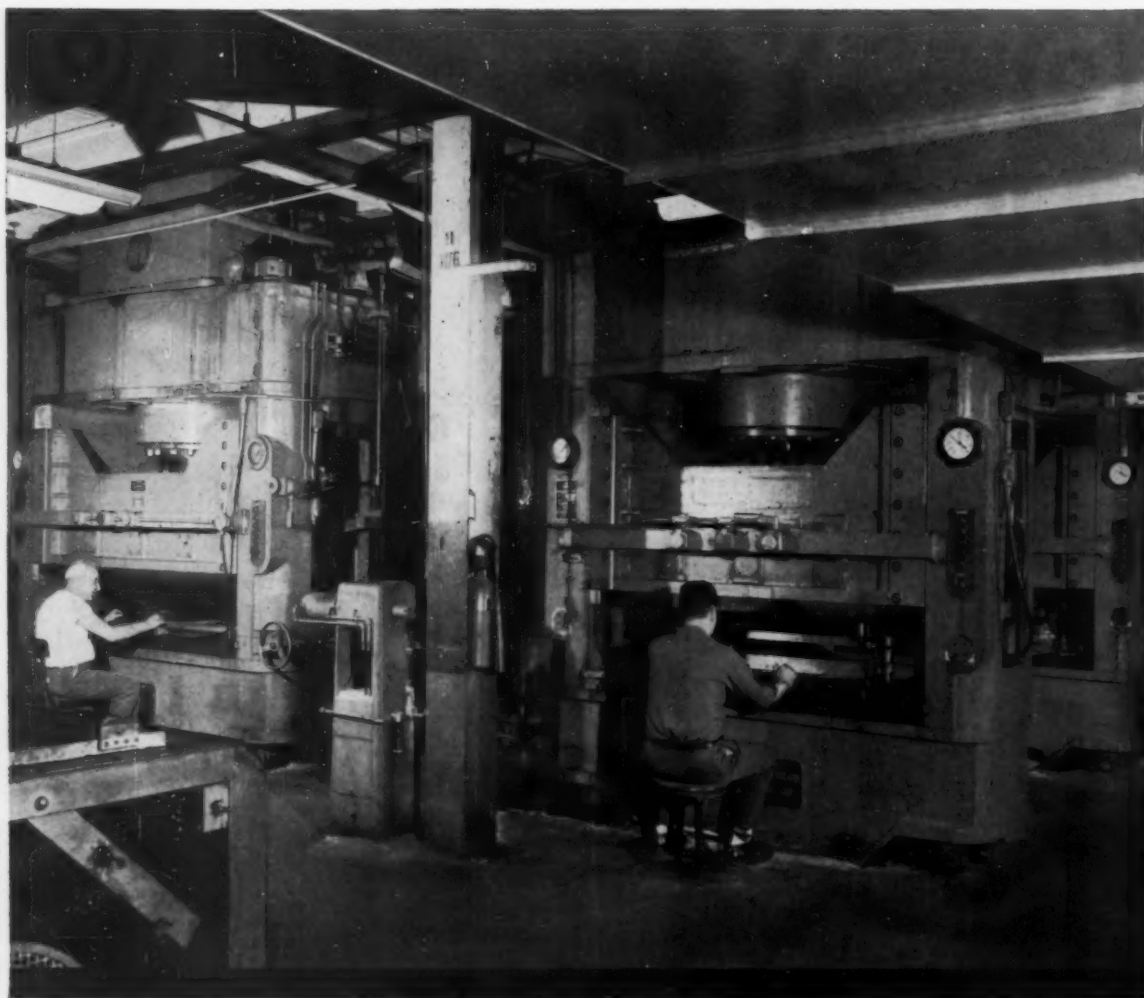
Every man responsible for performance, from design engineer to service manager owes it to himself to get the story on Ajax Dihedral Gear Type Couplings, the greatest improvement in couplings since the beginning of the industry. Write for full information right now.

AJAX FLEXIBLE COUPLING CO. INC.

Representatives in Principal Cities

WESTFIELD, N. Y.

TO BE SURE IT'S H-P-M



Material flows through this press department smoothly and efficiently. Special frames on these short stroke H-P-Ms permit use of presses in areas with low ceiling limits. H-P-M fits the equipment to the job without sacrificing normal press efficiency.

AT Westinghouse

■ The effective utilization of important floor space in today's busy plants calls for maximum production per square foot. At the Westinghouse Electric Corporation in Mansfield, Ohio, waste motion and waste floor space are eliminated wherever possible. Seven H-P-Ms, from 200 to 600 ton capacities, are fitted into a compact press room facility. Metal forming operations are concentrated in minimum space for greatest economy of operation and material handling.

H-P-M All-Hydraulic presses are versatile . . . adapt easily to modern metal forming jobs. H-P-M's exclusive closed-circuit FASTRAVERSE system of press operation is infinitely adjustable, permitting the press to be easily and quickly regulated for each specific application. Accurate control of drawing speed, plus total elimination of high impact stresses, guarantees proper metal flow. Independent control of each hydraulic action provides just the right tonnage for each job. H-P-Ms have become basic press room equipment for hundreds of industries both here and abroad. There's a reason . . . may we send you complete information?



What could you do with six H-P-Ms in a compact area like this? Let H-P-M engineers plan your complete press facility—show you how to be SURE with money-making H-P-Ms.

METAL WORKING DIVISION
**THE HYDRAULIC
PRESS MFG. CO.**

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RAKE IN EXTRA... PROFITS



CONVERT YOUR MACHINE TURNINGS INTO
HIGHER MARKET VALUE *With...*

American CRUSHER
METAL TURNINGS

NOW PRODUCING SHOVELING CHIPS FOR SCORES OF
AMERICA'S BLUE CHIP COMPANIES

- \$3 to \$4 More Per Ton for Chips than for long machine shop turnings.
- Up to 50 Gallons Cutting Oil Recovery Per Ton.
- Saves 75% of Storage Space. Heavier freight car loads cut shipping costs.

CUSTOM BUILT HOPPERS TO FIT YOUR INSTALLATION

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American PULVERIZER COMPANY
*Originators and Manufacturers of
Ring Crushers and Pulverizers*

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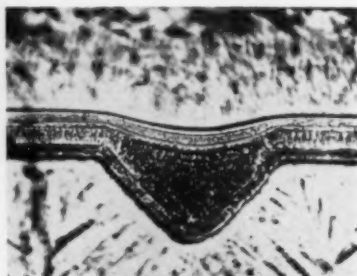
TECHNICAL BRIEFS

Plating:

Photomicrographs show new
process characteristics

High leveling characteristics of a new bright nickel plating process are revealed in photomicrographs taken at Hanson-Van Winkle-Munning Co., where it was developed.

First photo, magnified 1,000 times, shows grooved rough surface at center of picture. Two coatings have been applied. First coat leveled the metal; the second, a thin coat-

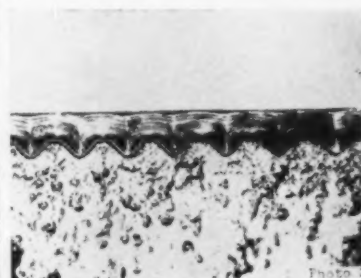


Magnified 1000 times, grooved rough surface can be seen.

ing at top, was applied for brightness. Total thickness of combined coats: 0.0015 in.

Second photo, magnified 120 times, shows surface with series of grooves, 0.0015 in. deep. Area above grooves is a bright finish, 0.002 in. thick. High leveling characteristics are indicated by deposition evenness.

It is reportedly the first bright nickel process to combine qualities of "full" brightness, high leveling



Magnified 120 times, series of grooves 0.0015 in. deep show.

and exceptional speed. Field tested in several high-production installa-

tions, it has indicated deposition rates 100% higher than comparable processes.

Practically any existing nickel plating installation can be converted to it in a few days, company reports. No special auxiliary equipment is required. Almost any rubber-lined tank previously used with bright nickel solution can be employed.

New addition agents are said to be the key to process' success. These make it possible to use an activated carbon pack plating solution filter. This continuously removes harmful organic contaminants, eliminating need for periodic batch purification.

They also report these advantages: (1) Good ductility and controlled stress in pressive or tensile side. (2) Plating within wide current density range. (3) High leveling characteristics. (4) High deposit surface activity. (5) Uniform recessed surface area brightness.

Methods:

Packaging, de-reeling, shipping problems are solved

A steel pail has solved three of the most troublesome problems of the magnet wire industry—packaging, shipping and de-reeling.

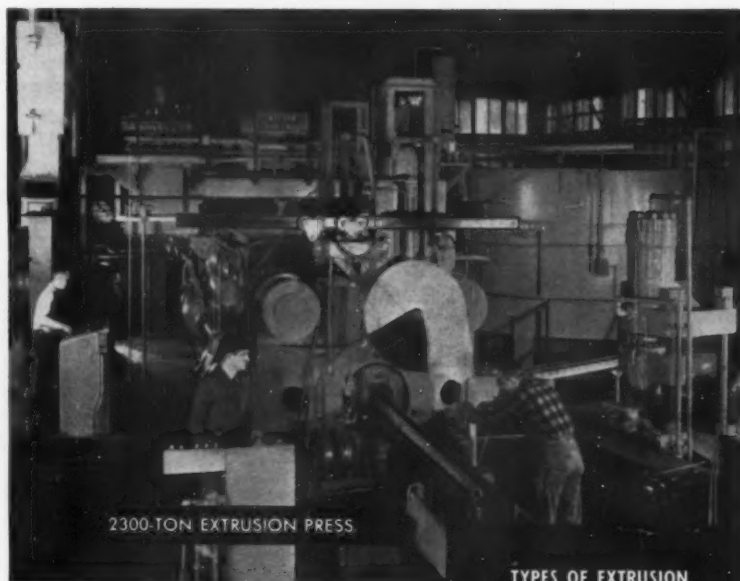


Coil winding machine takes magnet wire out of steel pails.

Enthusiastic reception of this new wire container by electrical manufacturers is reported indication of possible application as a package for wires of all types: brass, aluminum, stainless steel, alloys, welding and soldering wires.

According to Jones & Laughlin Steel Corporation's Container Div.,

In the market for an extrusion press? These are our qualifications



Backed by the company's 100-year experience in designing and building hydraulic equipment, Watson-Stillman engineers have helped leading manufacturers in many industries to find the best press for a specific job—in boosting extrusion speed and efficiency. These men are ready to go to work on your problem, too—with a complete service, from press design to final installation and operation.

Watson-Stillman extrusion presses come in standard designs from 600-5,000 tons (special sizes to order) for extruding the metals and materials listed. Write for details.

WATSON-STILLMAN PRESS DIVISION

Farrel-Birmingham Company, Inc.
162 Aldene Road, Roselle, New Jersey

European Subsidiary:

WATSON-STILLMAN INTERNATIONALE,
Maatschappij N.V., Groothandelsgebouw-Rotterdam-
Holland

OTHER WATSON-STILLMAN EQUIPMENT

Forming, drawing, forging, trimming, hobbing, straightening and bending presses for the metal-working industry.

FARREL ROLLING MILL MACHINERY

Rolls • Rolling Mills • Slab, Rod and Coil Handling Equipment • Universal Mill Spindles • Rod Coilers • Slitters • Gears • Mill Pinions • Pinion Stands • Gear Drives of Any Capacity • Flexible Couplings • Roll Grinding Machines • Roll Calipers

WS-15

TYPES OF EXTRUSION PRESSES BUILT BY WATSON-STILLMAN

aluminum
brass
bronze
carbon
ceramics
copper
cordite
crayon
graphite lead
lead pipe
magnesium
phosphor bronze
silver alloys and
precious metals
solder
steel
welding rod
wire



600-TON EXTRUSION PRESS

use of steel pail as a wire container results in manufacturing economies, simplifies materials handling, eliminates a complete bookkeeping phase, and makes a package that provides high protection against transit and storage damage for wire.

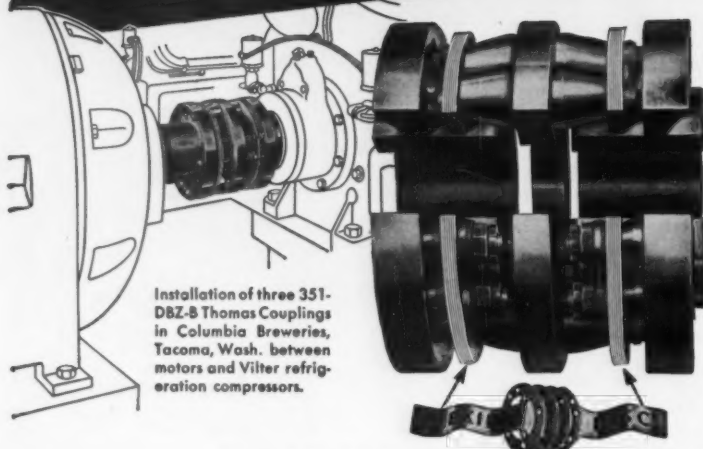
Magnet wire is fine-drawn, film-insulated copper wire used in devices such as transformers, motors, generators, solenoids and coils which use an induced magnetic field.

Past practice has been to put finished wire on spools. These were shipped to customer in cases.

Spools' size and capacity are limited by wire's tensile strength since it is used to rotate the spool when taken off.

Small spool capacity means winding machines at the wire-user's plant are frequently shut down to load them with full spools. Pail is said to reduce machine downtime considerably.

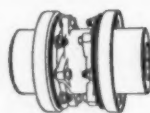
THOMAS FLEXIBLE COUPLINGS... for more years of better service!



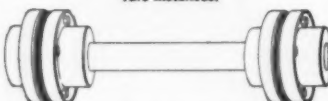
Installation of three 351-DBZ-B Thomas Couplings in Columbia Brewery, Tacoma, Wash. between motors and Vilter refrigeration compressors.

Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.



Write for our new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING COMPANY

Largest Exclusive Coupling Manufacturer in the World
WARREN, PENNSYLVANIA, U.S.A.



Foundry:

Steel division takes delivery of cold-rolling mill

Largest of its kind in the spring industry, a new 16 in. Sendzimir cold-rolling mill, is the first designed specially to use a water-emulsifiable mineral oil as coolant and lubricant for the rolls. It has just been placed in full-scale operation at the Forestville, Conn., plant of Associated Spring Corp.'s Wallace Barnes Steel Div.

The new mill is capable of rolling strip steel up to 13 in. wide, and will increase by up to 50 pct the steel-rolling capacity of the Forestville plant's facilities.

New mill will make possible rolling much thinner gages of steel than was possible before. It also provides, by automatic con-



Mill is capable of rolling steel strip up to 13 in. wide.

trols, greater accuracy in the gage of the steel rolled, and much greater uniformity of thickness across the width of the strip as well as along its length.

The mill was designed by the Armzen Co., Waterbury, Conn., and built by Waterbury Farrel Foundry & Machine Co., of the same city.

Where the Steel Goes

About 30 pct of the cold-rolled high carbon steel produced at Forestville is used by the other divisions of the corporation to make precision mechanical springs and spring steel products. The remaining 70 pct, by far the larger share of the output of the steel division, goes to outside customers, such as the automotive industry for various parts.

The new 16-inch mill is the most recent step in a modernization and expansion program for this division which began in 1948. At that time, all of Wallace Barnes' steel manufacturing facilities were moved from Bristol to Forestville, and concentrated in a new modern one-story building.

The modernization program of this division has seen major additions of equipment each year since then. Other additions have included a United 17-in. four-high reversing cold strip mill and seven Lee Wilson bell type annealing furnaces with sixteen bases.

Inspection:

Radioactivity detector has Geiger Multiplier

A new kind of radioactivity detector is expected to seriously challenge the present supremacy of the scintillation counter. This instrument features use of a new "Geiger Multiplier" tube, and is described as a new approach in Geiger counter development.

It provides greater sensitivity than any economically competitive scintillation counters, according to Radiac Co., the manufacturers. The Geiger Multiplier tube is described as a bundle, or sheaf of Geiger tube elements in a common housing, of which the cathodes are in the form

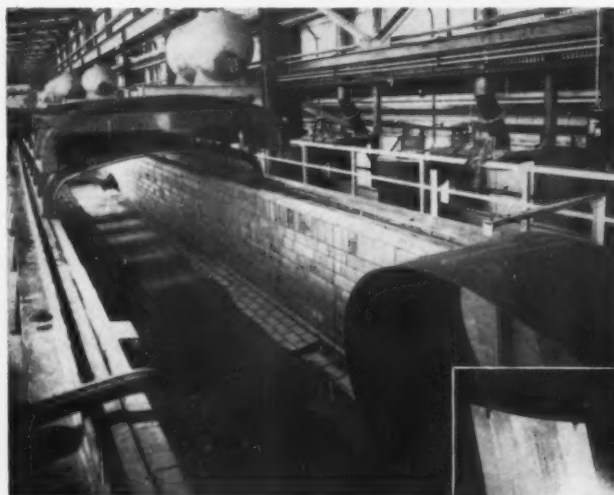


Radioactivity detector uses a new Geiger multiplier tube.

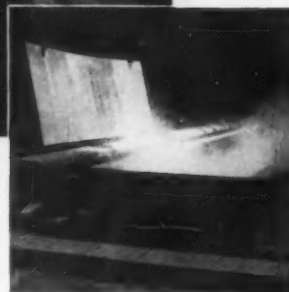
of grid-like screens. This is said to offer several chances for each gamma ray to produce an ionizing event. Thus, a greater percentage of the incident radiation results in the click-producing "electron-avalanche," maker says.

ATLAS PICKLING TANKS

in service to stay



Atlas provides a complete corrosion service from on-the-spot technical advice through engineering design to complete construction facilities to carry the job from beginning to end.



When you install pickling tanks, you have a right to expect them to deliver service in full measure. You can't get it if these units are the cause of lost production due to down time for repair of corrosion damage.

Pickling tanks of Atlas construction reduce down time to a minimum, because Atlas cements, coatings and linings are designed to handle the rugged abuse of modern pickling.

For a quarter century Atlas has been producing Corrosion-Resistant materials of construction for industry-wide use in combatting corrosion. Atlas, with the advance of technical knowledge, has developed new materials and improved existing products to keep pace with the increasing use of strong pickling agents and higher processing temperatures.

Now Atlas can offer the most complete line of quality corrosion-proof materials available. Your pickling tanks will become a permanent asset when you make sure that ATLAS CORROSION-PROOF CEMENTS, COATINGS, and LININGS are specified.

Write for your copy of
Atlas Bulletin CC#3 contain-
ing informative data on the
complete Atlas line.



MERTZTOWN, PENNSYLVANIA

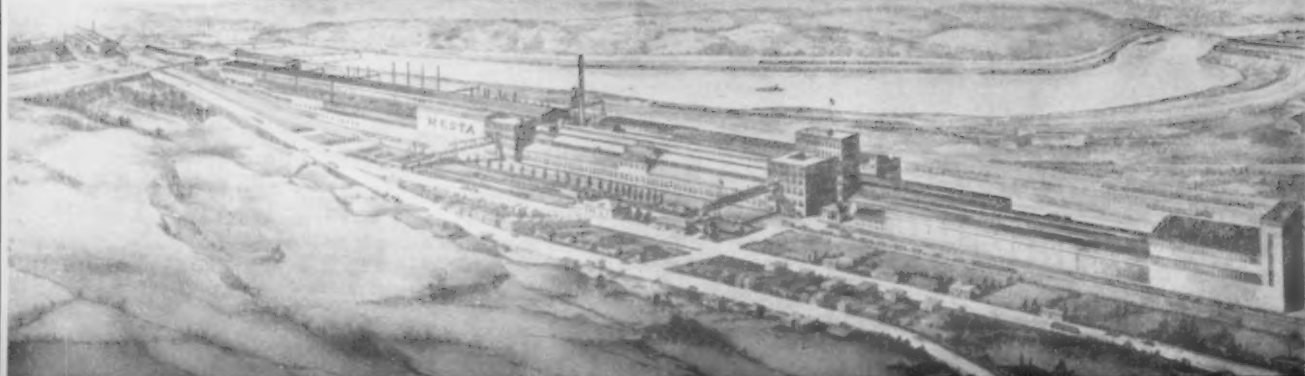
**DESIGNERS
and BUILDERS**

of Complete

STEEL PLANTS



THERE IS NONE BETTER



MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA

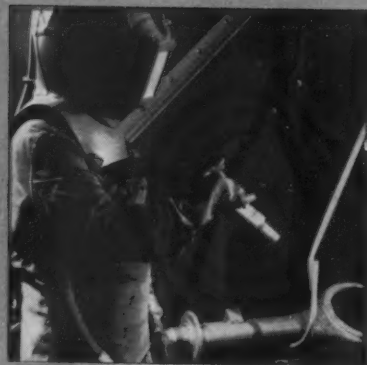
HOW TO GET MORE FOR YOUR METALWORKING DOLLAR

THE IRON AGE

SPECIAL FEATURE

Number 5 of a series

PLATING



METAL CLEANING AND FINISHING HANDBOOK

June 28, 1956

How To Get More For Your Finishing Dollar

There's no end to efficiency in a plating shop. Today's knowledge of this complex business makes it so. But this complexity simply breeds opportunities for making your finishing dollar stretch further.

The alert plater looks for them, and once found, makes the most of them. From the design stages to the finished product, no area is too small to explore for cost-cutting ideas. An effort is made here to recall some in small as well as large plating plants.

As a worthwhile aid to metal finishers, The Iron Age has compiled in condensed form data for practical shop use. Tables on surface finishing, cleaning, rust prevention, electroplating, mechanical finishes and other related subjects appear in the second section of this feature.

Section 1

PLATING

Management's Duties	p. 99
Plant Maintenance	p. 100
Layout	p. 100
Product Design	p. 101
Water Supply	p. 103
Plating Wastes	p. 103

Section 2

METAL CLEANING AND FINISHING HANDBOOK

Surface Treating	p. 107
Cleaning and Pickling	p. 112
Paints, Lacquers, etc.	p. 116
Mechanical Finishing	p. 117
Rust Preventives	p. 122
Metallic Finishes	p. 124

Management's Part

Maintenance

Overhead

Layout

Small Benefits

Product Design

Drag-Out

Raw Water Supply

Waste Disposal

PLATING

♦ EVERY SO OFTEN, a discussion comes up as to whether plating is a science or an art. Before it ends, you can give odds that it'll wind up with both sides being right. The science of plating is what platers preach, and the art is its application.

After one quick look around your plant, you may even conclude that it's neither. You inhale some fumes, kick through several puddles, brush by a few corroded tanks, and you're about ready to condemn the plating shop foreman for the whole shoddy, inefficient plant. After all, he's the key man . . . he's in charge of the machines, the tanks, the solutions and all the people who operate the plant.

Chances are, though, that the foreman is merely carrying out the attitude of management. So don't be too hasty in blaming him for the inefficiency, waste, poor plating and equipment breakdowns. A progressive management can pull its plating practice up by the boot straps if it so desires. A great many plants prove this point. Let management pass the word down and it won't be long before its thinking is reflected by every plater.

But management must go even further. It can't just say it's in favor of good plating practice and let it go at that. It must provide the facilities and equipment conducive to good plat-

ing practice. It must leave the actual plating end of the business to platers; consult with them in every instance where policy affects plating even remotely.

Plating is a corrosive business. No other industry handles the variety of chemicals that'll constantly eat away at your plant, equipment, health and profits. Seek and value expert advice at every planning stage—plant location, layout, equipment, controls, product design, and others. Provide for solutions to these problems now and you'll save up to 300 pct in maintenance costs later.

Start by checking the plant

Take the floors in your plating room as an example. They must be rigid enough to firmly support fully loaded tanks and other equipment. Yet, many are made of ordinary concrete which is readily and severely attacked by acids such as sulphuric, nitric and hydrochloric, plus many others. You can avoid headaches later by applying an impervious barrier of special asphalt over the concrete base. If the floor must stand the pressure of truck and dolly wheels, lay acid-resistant brick or tile over the asphalt and seal it with acid-resistant mortar.

In your fight against plating room corrosion, don't forget to provide good drainage by insist-

ing on properly constructed drains and pumps. It's part of good housekeeping. But it'll also show up as an intangible saving in labor cost since it's bound to increase worker morale and productivity. At the same time, it'll keep corrosive moisture out of every nook and cranny which otherwise will give you a real maintenance problem.

Keep in mind, too, that pits for tanks are just as important, or more so, than the floors. Give them at least equal attention in the planning and construction stages.

Check your plant for its steel structure. Every exposed square foot of it offers a potential saving each year in maintenance cost of 18 to 20¢. Good design will cost somewhere between 6 and 10¢ per sq ft for painting each year. Compare this with the 20 to 30¢ that it can reach.

Any ordinary paint just isn't good enough for coating steel surfaces in a plating room. There are a number that do a good job; among them are the neoprene, vinyl and oleoresinous types. If you really want a top-notch job, have the surfaces sandblasted to give the paint a good base. Otherwise, except for appearance, a big part of the cost is going down the drain. Keep an eye on the painters, too, to make sure they give a minimum of a 5-mil thickness. Anything less than that is virtually worthless.

But what does all this maintenance business have to do with plating costs? It's simply that plant upkeep, plus all the other items such as trial runs, rework, equipment repairs and scrapage are lumped under overhead. Moreover, overhead charges run to a seemingly fantastic figure in a plating shop—often 200 to 250 pct of the actual plating cost. They're legitimate charges but the customer may not realize this, and furthermore, he's not interested. It's strictly up to you to hack away at those costs and thus make the customer's price more attractive.

Provide adequate space

Plant layout is another fertile spot for cost reduction. Poor layout not only increases overhead costs, but bears heavily on direct labor cost. Adequate space is probably the most important requisite both from the maintenance and processing standpoints. Keep aisles at least 4 ft wide so you can move around in them. But also keep tanks at least 18 in. away from the walls so that repairmen can get at piping.

You'll need space, too, for racking parts, repairing or assembling racks, temporary storage of parts (incoming, intermediate and outgoing), storing chemicals, solution makeup and the like. Provide for these areas, then watch your operating efficiency jump to a new high. Again, it's just another job for you to tackle to convince workers that you're dead serious about boosting productivity, but not at his expense.

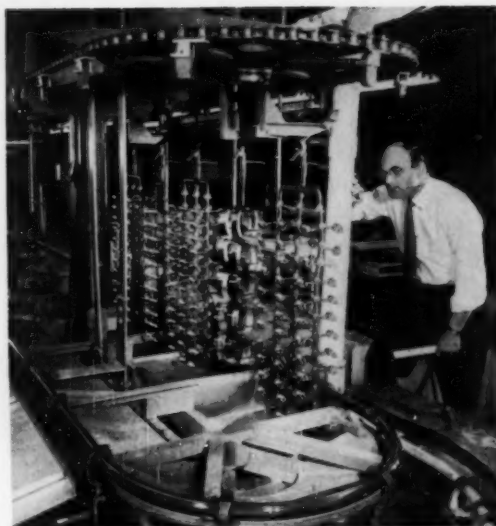


Photo by Ajax Mfg. Corp.

GOOD HOUSEKEEPING and good plating go hand-in-hand. Keeping the plating shop free of oil, grease and dirt can insure work quality.

Conditions might be entirely different in your plant. Your setup is established, and you're cramped for space as it is. In fact, you may not even have enough room for that new tank or machine you've been thinking about. If that's your predicament, you might do well to get some flat cardboard layouts of your equipment and start moving them about a scaled plant layout. It's likely that you'll not only find that extra space, but wind up with a processing arrangement which will fit your needs more appropriately. Some shops have arranged their equipment so that one cleaning line serves two or more plating lines.

It's not always necessary to turn the plating shop upside down to increase efficiency. Watch for the little operations. A lot of small ideas may eventually be worth more than one big sweeping change. Study what route the product takes from beginning to end. Determine how many times it's handled enroute. Analyze each individual operation. Find out, too, how the batches of parts are scheduled for each operation.

After you've accumulated all the facts, ask yourself why each operation is done in a particular location at a particular time. Can you relocate or reschedule the work to save time or labor? Perhaps one employee was doing a job that someone else could handle a little more conveniently. If so, balance off the work load to get more uniform product flow.

Give some thought to the product itself. Someone's passed the word to you that it must get this kind of plate, on such and such a metal, and it's so big and so round. Furthermore,

they're going to send you a certain number of boxes of these parts on a rush order. You tell the design man or the production engineer about your problems in throwing power, the solutions, the anodes and cathodes, and they're lost. Yet, they should have consulted you before the design was approved. Often, just a slight change could eliminate unnecessary headaches and expense, and result in better quality.

As a plater, get yourself into the thinking on design. Let others know that the solution must reach every area to be plated; that cavities may trap air and prevent plating; that areas not to receive plating must be masked by some means; that uniform plating hinges a great deal on the part's shape.

Only one idea may help

Passing along only one thought during the design stage may change the complexion of the plating job. Take, for example, a part slated to receive a two-tone effect. True, you can mask it . . . at considerable time and expense. You can also plate it by partial immersion. But it might be much simpler to design the product in two or more parts and assemble it after plating.

A certain amount of dragout from plating solutions is unavoidable. But if the part has been designed so that it cups the solution, it can quickly mess up the whole plating line. In some cases, you may be able to position the part so it drains properly. On the other hand, providing for a drainage hole during the design stage might be much simpler.

Roll-formed and stamped parts pose similar problems. If the part is such that a drainage



Photo by Hanson-Van Winkle-Munning Co.

TOP SPRAY RINSING in the final stage is highly effective. Thorough rinsing minimizes spotting and staining . . . and cuts down corrective buffing.

hole cannot be provided, you'd do well to suggest switching to castings or extrusions.

Dissimilar metal combinations in assemblies are still another sore spot. Again, you may recommend material changes so that the metals are similar. If this can't be done for engineering reasons, perhaps the better answer is to plate the parts separately, then assemble.

Plating does not correct poor material sur-

Points For Efficient Plant Layout

1. Storage areas for incoming and outgoing parts.
2. Adequate space for racking.
3. Aisles wide enough for material handling.
4. Space for access to tanks, pumps, piping and other equipment.
5. Room for storage, repair and insulating racks.
6. Facilities for solution reclaim, makeup and storage.
7. Separate facilities for buffing.
8. Protected area for power equipment.
9. Sufficient area for processing.
10. Control and testing facilities.
11. Area for water treatment.

Good Part Design Calls For

1. Immersion of all surfaces to be plated.
2. Ability to rack workpieces securely and make good electrical contact.
3. Satisfactory plating of dissimilar metal assemblies.
4. Minimum of masking.
5. Minimum of cupping and drag-out.
6. Ability to rinse thoroughly.
7. Elimination of unsealed overlapping edges.
8. Elimination of sharp projections and deep recesses where uniform plating is required.
9. Suitable surface finish of basis metal.
10. Allowance for dimensional changes.

faces nor poor design. In fact, in some cases it'll even exaggerate them. Where uniform surface finishing is required, be sure to make this point clear to the manufacturer. Don't accept the work if it has pores, seams or laminations, otherwise it'll appear that plating isn't a science after all. If you have to take it, let the producer know what to expect before you plate.

Put scratches and gouges in the same category. If you accept these jobs, it's going to cost you money to cover up someone else's shoddy work. Be sure to tell the producer, too, that the finish isn't going to last very long.

Complex shapes require greater pains.

You'll probably be challenged from time to time with complex shapes requiring reasonably uniform plate thickness. They'll be difficult to plate, yet not necessarily impossible. But keep in mind that the overhead charges for such jobs are substantially higher than for those which fall within so-called normal process limitations.

Any talk of getting more mileage from your plating shop invariably leads you to real earnestness about replacing your manually-operated equipment with semiautomatic or fully-automatic. Only three things seem to stand stand in your way—money, work volume and size, and the prospect of continuing orders. Most other factors weigh heavily in your favor.

Let's see what you stand to gain. First, you

extend the weight and size limitations previously set by what the operator could conveniently handle. Secondly, your cleaning, rinsing, plating and transfer times will no longer be dependent upon the operator. You put him on other essential jobs, and at the same time eliminate over-plating and under-plating. The move also saves on plating materials and equipment. Because transfer time can now be controlled automatically, drag-out losses are cut sharply. To these benefits, add better quality, fewer rejects, smaller floor space requirements, greatly increased capacity and others.

It used to be that a large enough volume of any one kind of work justified the expenditure for an automatic machine. That's not necessarily so any longer. Today's machines have much more flexibility. Skip mechanisms allow you to preselect the cycle for each rack or barrel of parts. They're useable for both electrolytic and non-electrolytic processes. If you've included anodizing or electropolishing among the electrolytic processes, it's easy enough to switch from these to processes like pickling, blackening and bright dipping which require no power.

Even the money angle has been made somewhat easier by the development of smaller-scale automatics which do just about everything capable of their bigger brothers. They're stand-

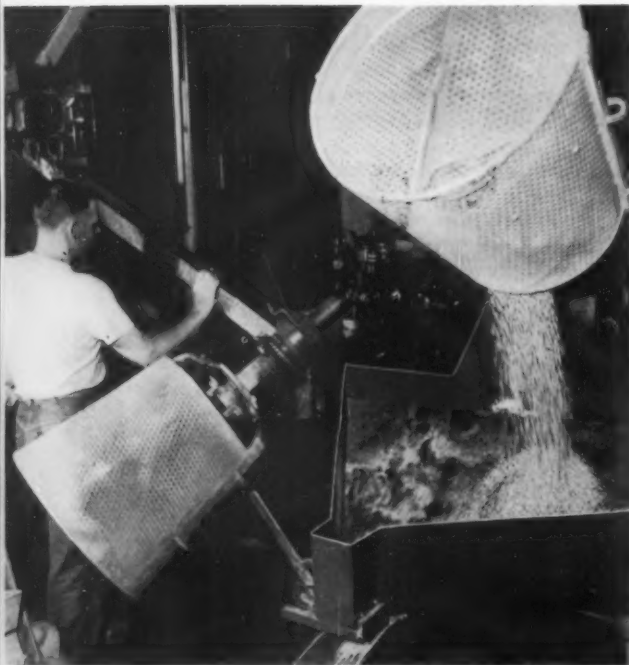


Photo by Frederic B. Stevens, Inc.

AUTOMATIC loading and unloading saves time and effort, particularly when parts are small.

Where Maintenance Pays

■ Good plant design and layout is only one part of the battle against corrosion. Good housekeeping is the other. It will whittle down repair costs, decrease greatly on breakdowns and shutdowns, and extend the life of costly facilities.

1. Keep walls, ceilings and steel structure free of dirt and well painted.
2. Wash windows regularly and keep lighting fixtures in proper working order.
3. Paint pipelines for protection as well as color coding.
4. Check drains for strainers and inspect for clogging.
5. Inspect pumps for packing.
6. Check ventilating equipment against corrosion.
7. Calibrate meters and other control devices regularly.
8. Protect electrical conduit by keeping well painted.
9. Lubricate cranes and hoists, but don't over-lubricate coat exposed surfaces for corrosion resistance.

ard models and their cost is considerably below that of their larger counterparts.

All other things being equal, the third restraining factor—continuing good business—certainly won't be made any worse. In fact, your competitive position should improve. You'll be better able to sell higher quality in larger quantity. Delivery schedules will be stepped up too. These aren't all the aspects to consider before making the investment, but they're mighty convincing ones.

Regardless of the equipment you have or plan to get, its enormous thirst can be your No. 1 problem. First, you'll not only need a plentiful water supply but one which is low in impurities. Secondly, you're obligated to dispose of it in relatively harmless condition.

Place emphasis on rinsing

The biggest water consumers by far are the rinse tanks. Good rinsing practice calls for efficient, effective use of water. You can't afford to overlook its importance. It'll help you avoid peeling, blistering, spotting and staining. As a bonus, you'll conserve water and chemicals. Neglect it and you'll run into the very problems you strived to avoid in plating. Corrective buffing simply adds to your expense and reduces plate thickness.

Get as much agitation as possible in dip rinse tanks, but not to the extent that spillage becomes excessive and parts are knocked from racks. Keep surface water moving toward the overflow. If the parts are not too deeply recessed, spray rinses will do a more effective job. Otherwise use dip tanks, followed by spray rinses placed directly over the dip tanks. To conserve water, install controls which will turn the water on and off automatically when parts enter the spray rinses.

Reclaim rinses stand to save you about 50 pct of total drag-out. If part design is responsible for excessive drag-out, it may pay you to install a more elaborate recovery system. Drag-out losses can be dropped enough by its use to justify the initial investment.

In terms of plating quality, your raw water supply can be a bigger headache than poor rinsing practice. It's especially important to use water free of impurities in the final rinses. Without it, you're apt to run into a raft of difficulties. Moreover, impurity content need not be very high to cause such faults as surface roughness, haziness, pitting, poor color, staining and others. Dollar-wise, it cuts deeply into your earnings since considerable reworking is involved.

Where symptoms of this nature show up, the wise approach is to get expert advice. Determine which impurity is the source of trouble, then find out whether filtration will remedy the condition, or whether it'll be necessary to resort to other treatments.

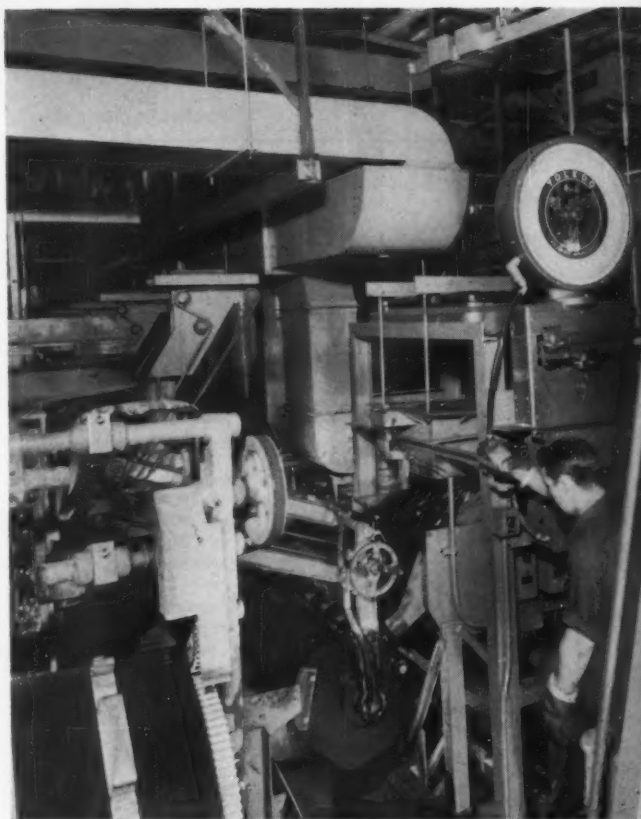


Photo by The Udylite Corp.

WEIGHING of each barrel load of pieces automatically keeps this mechanized setup moving without any interruption in the plating cycle.

In recent years, more and more platers have recognized the value of ion exchange equipment (demineralization) for treating used rinse water or raw water. They've found that such equipment has eliminated many ills previously associated with high-solids raw water. Deionized water gives them better work quality, improved control and far fewer spots and stains thus eliminating extra buffing and handling. All these benefits add up to sizable savings.

Another dollar-saving tip about ion exchange equipment is the fact that it's possible to recover certain waste products such as copper, nickel and chromic acid. One chromium plating plant invested \$45,000 in an installation, but by simply recovering the chromic acid, it receives a net profit of more than \$25,000 per year.

Very often, the nature of the plating operation virtually dictates the use of demineralized water. Take the case of the instrument maker who plates tiny precision parts. Nothing but the best finish will suffice. Moreover, they're so small, he can't very well buff them. And it's a question of whether he'd want to attempt it

Hints For Tracing Common Defects Quickly

Defect	Possible Causes	Corrective Measures
Faulty adhesion and misplating (Blistering and peeling)	Improper or inadequate cleaning of basis metal.	Hand clean and immerse directly in first plating bath. If adhesion is good, check surfaces of acid dips and rinse tanks for contamination. If defects recur, test plating solutions for contamination. Change in basis metal may require different preliminary cleaning cycle.
Blotching and streaking	Drying of parts in transfer. Improperly cleaned parts, or unbalanced plating solutions.	Lower cleaning solution temperature, eliminate wetting agents from cleaners, and mist spray parts in transfer. Degrease or wet tumble small parts prior to preplating cycle. Test solutions.
Roughness	On steel—silvers remaining on surface after polishing. Inadequate cleaning. On horizontal surfaces—settling out of solids in plating bath. Poor anode corrosion. Metallic impurities in alkaline solutions. Breaks in filter diaphragms and anode bags. Burning of work surface.	Use fine emery and grease stick or tampico brush. Add anodic cleaning before spray wash in preplating cycle. Filter solution. Adjust anode current density in cyanide solutions or use anode bags in acid baths. Check for sources of dust from overhead structure, sliding contacts, proximity of polishing or buffing operations. Replace diaphragm or bag. Lower current density.
Pitting	Hydrogen bubbles adhering to work. Air leaks through pump or line.	Small addition of sodium cyanide or organic material to bath. Where permissible, use air agitation. Check pump packing.

since the parts are for very precise instruments. Yet, precipitates are contaminating his rinse water and causing a film to form on the work.

One firm found itself in just this predicament. Getting a practical solution to the problem wasn't easy, but the effort and investment which went into it paid off. Briefly, it installed a \$35,000 demineralizing setup and started off by treating enough raw water to fill all plating and rinse tanks. It then switched over to treating and recirculating the rinse water. The outcome was that it saves more than \$5000 yearly compared to the cost of demineralizing raw water for rinsing and running it down a drain.

Study each angle carefully

These are only two examples of how you can apply the science of plating not only to solve perplexing problems, but to do it economically or even profitably. In other cases, it is possible to use certain waste chemicals for self-neutralization and thus save on disposal costs. All these measures—and there are dozens of them—can keep you in the black if they're studied and applied intelligently.

Stretching the plating dollar extends into areas normally not considered to have much effect on the cost picture. Take the fellow whose main job is to load and unload the plating conveyor. Have you trained him to spot faulty plating when it occurs? Have you told him or showed him what immediate steps to take? Is he alert to equipment or instrument failures? If you haven't trained him along these lines, do

it and he'll feel that his job is a more responsible one. But more important, the time and effort you spend may be repaid many times over by fewer rejects, less reworking, getting the machine back into production faster when failures do occur.

The gamut of possibilities for saving a few pennies here or making a few dollars there is virtually endless in the plating shop. But so is the job of looking for them. Alertness to opportunities, experience, knowledge, desire and good judgment all go hand in hand in making plating the science it is, applied skillfully as an art.

There's no substitute for an experienced operator in many instances, but it's the alert operator who will spot faulty plating quickly. Where to look for sources of trouble can often be a problem, but even here a little training can go a long way. In many cases, the faults themselves gives clues to the more likely trouble-spots. But the approach to any difficulty should be systematically, and with good judgment.

WANT EXTRA COPIES?

A limited number of copies of "How To Get More For Your Plating Dollar" including the Metal Cleaning and Finishing Handbook will be available upon request to Readers' Service Dept., The Iron Age, Chestnut and 56th Streets, Philadelphia 39, Pa.

METAL CLEANING AND FINISHING HANDBOOK

Table 1	Spot Test Identification of Metal Surfaces
Table 2	Phosphate Surface Treatments
Table 3	Surface Treatments for Aluminum Alloys
Table 4	Chemical Treatments for Magnesium Alloys
Table 5	Chemical Conversion Coatings
Table 6	Metal Conditioning (Surface Cleaning)
Table 7	Typical Electrolytic Cleaning Operations
Table 8	Typical Immersion Cleaning Operations
Table 9	Typical Spray Cleaning Operations
Table 10	Comparisons of Pickling, Degreasing, Cleaning and Descaling
Table 11	Properties and Uses of Chlorinated Solvents
Table 12	Infrared and Convection Drying
Table 13	Typical Organic Coating Properties
Table 14	Deburring and Finishing With Non-Metallic Mediums
Table 15	Deburring With Metallic Medium
Table 15	Recommended Sizes of Shot and Grit
Table 16	Cast Shot Numbers and Screening Tolerances
Table 17	Cleaning Grit Numbers and Screening Tolerances
Table 18	Polishing Wheel Grit Sizes
Table 19	How to Select Power Brushes
Table 20	Rust Preventives
Table 21	Metallic Coatings
Table 22	Specification Plating
Table 23	Nickel Electroplating Baths
The Iron Age	June 28, 1956

TABLE 1 SPOT TEST IDENTIFICATION OF METAL SURFACES

SEQUENCE "A"

Sequence "A" is for testing white metals when it is not certain whether they are surface treated or not. Place a drop of the specified solution on the metal for 0.5 min.

1. Hot 20 pct NaOH	Violent Reaction May Be Al	No Reaction	ALUMINUM
	Slight Reaction May Be Zn	Colorless Reaction	ZINC
No Reaction			Proceed to (2)
2. Concentrated HCl and transfer the reaction product to a filter paper and add a solution of 2.7 oz H ₂ SO ₄ 1.3 oz Potassium Ferricyanide Per Gal of Water	Blue Spot	Iron Content and Test for Nickel and Chromium	STAINLESS STEEL
	Blue Reaction	Copper Content (Test for Nickel)	MONEL or WHITE BRASS
3. Concentrated HCl and Colorless or Red Reaction. Transfer the reaction product to a filter paper and add an excess of Ammonia	Yellow Reaction	(Check for Silver)	SILVER
	Slight Reaction		MAGNESIUM

SEQUENCE "B"

Sequence "B" is for testing white plated surfaces. Place a drop of the specified solution on the metal for 0.5 min.

1. Concentrated HCl, Green Reaction. Transfer reaction product to a filter paper and add Ammonia and Dimethylglyoxime	Colorless Spot	CHROMIUM
	Red-Pink Spot	NICKEL
2. Concentrated HCl, Colorless Reaction. Transfer reaction product to a filter paper and treat the reverse side of the paper with powdered Cacotheline	Violet Spot	TIN
	White Spot	ZINC
3. No Color From Test (2), then place a drop of Concentrated HNO ₃ and transfer reaction to a filter paper and add Ammonia and Sodium-Sulfide	Yellow Spot	CADMIUM
	White Spot	LEAD
4. Brown or Black Reaction in Test (3), then transfer the reaction product to a filter paper and add NaOH	Brown-Black Spot	SILVER
	No Reaction	RHODIUM
5. Concentrated Aqua Regia	Dissolves	PLATINUM
		Concentrated Nitric Acid will effect neither

SEQUENCE "C"

Sequence "C" is for yellow and colored metal surfaces. Apply an open flame to the "colored" metal surface

Carbonized or Softened	LACQUERED or PAINTED
To Unaffected Surface Add a Drop of Concentrated HNO ₃	
No Reaction	GOLD
Blue Reaction	COPPER or BRASS
Violent Reaction	DYED or TREATED MAGNESIUM
Colorless	
Color Faded	DYED or TREATED ALUMINUM
But No Reaction on Metal	

SURFACE TREATING

TABLE 2

PHOSPHATE SURFACE TREATMENTS

TYPE OF METAL	PHOSPHATE USED	PURPOSE	APPLICATION
STEEL SURFACES	Zinc Phosphate	Paint Bonding	Spray
			Immersion
		Rust Proofing or Oil Retention	Brush
			Immersion
	Iron Phosphate	Cold Extrusion	Spray
		Cleaning and Phosphating	Spray
		Phosphating	Immersion
	Manganese Phosphate	Wear Resistance	Immersion
ZINC SURFACES	Zinc Phosphate	Paint Bonding	Immersion
			Spray
			Brush
			Immersion
			Spray
ALUMINUM SURFACES	Zinc Phosphate	Paint Bonding	Immersion
			Immersion
	Chromate Phosphate	Paint Bonding	Spray
			Brush
			Immersion

Modified from data supplied by Pennsylvania Salt Mfg. Co.

TABLE 3

SURFACE TREATMENTS OF ALUMINUM ALLOYS

TREATMENT	PURPOSE	FOR USE ON	OPERATION	FINISH AND THICKNESS
ZINC PHOSPHATE COATING	Paint base	Wrought alloys	Power spray or dip. For light to medium coats, 1 to 3 min at 130° to 135° F.	Crystalline, 100 to 200 mg per sq ft
CHROMIUM PHOSPHATE COATING	Paint base or corrosion protection	Wrought or cast alloys	Power spray, dip, brush or spray. For light to medium coats, 20 sec to 2 min at 110° to 120° F	Crystalline, 100 to 250 mg per sq ft
SULPHURIC ACID ANODIZING	Corrosion and abrasion resistance, paint base	All alloys. Uses limited on assemblies with other metals	15 to 60 min, 12 to 14 amp per sq ft, 18 to 20 V, 68° to 74° F. Tank lining of plastic, rubber, lead or brick	Very hard, dense, clear. 0.0002 to 0.0008 in. thick. Withstands 250 to 1000 hr salt spray
CHROMIC ACID ANODIZING	Corrosion resistance, paint base. Also as inspection technique with dyed coating	All alloys except those with more than 5 pct cu	30 to 40 min, 1 to 3 amp. per sq ft, 40 v dc, 95° F, steel tanks and cathode, aluminum racks	0.00002 to 0.00006 in. thick, 250-hr min salt spray
CHROMATE CONVERSION COATING	Corrosion resistance, paint adhesion, and decorative effect	All alloys	10 sec to 6 min depending on thickness, by immersion, spray or brush, 70° F, in tanks of stainless, plastic, acid-resistant brick or chemical stoneware	Electrically conductive, clear to yellow and brown in color, 0.00002 in. or less thick, 150 to 2000 hr salt spray depending on alloy composition and coating thickness
CHEMICAL OXIDIZING	Corrosion resistance, paint base	All alloys, less satisfactory on copper-bearing alloys	Basket or barrel immersion, 15 to 20 min, 150° to 212° F	May be dyed, 250-hr min salt spray
ELECTRO-POLISHING	Increase smoothness and brilliance, paint or plating base	Most wrought alloys, some sand-cast and diecast alloys	15 min, 30 to 50 amp per sq ft, 50 to 100 v, less than 120° F, aluminum cathode	35 to 85 RMS depending on treatment
ZINC IMMERSION	Preplate for subsequent deposition of most plating metals, improve solderability	Many alloys, modifications for others particularly regarding silicon, copper and magnesium content	30 to 60 sec, 60° to 80° F, agitated, steel or rubber-lined tank	Thin film
ELECTROPLATING CHROMIUM	Decorative appeal and/or functional	Most alloys after proper pre-plating	Applied directly over zinc immersion coat, 65° to 70° F, 6-8 v, 200-225 amps per sq ft. Transfer to bath at 120° to 125° F if copper, or copper and nickel have been applied	Same as on steel
COPPER			Directly over zinc, or follow with copper strike then plate in conventional copper bath	
BRASS			Directly over zinc, 80° to 90° F, 2-3 v, 3-5 amp per sq ft	
NICKEL			Directly over zinc, or follow with copper strike then plate in conventional nickel bath	
CADMIUM			Directly over zinc, or follow with copper or nickel strike, or preferably cadmium strike, then plate in conventional cadmium bath	
SILVER			Apply copper strike over zinc using copper cyanide bath, low pH, low temperature, 24 amp per sq ft for 2 min, drop to 12 amp per sq ft for 3 to 5 min; plate in silver cyanide bath, 75° to 80° F, 1 v, 5-15 amp per sq ft	
ZINC			Apply directly over zinc immersion coating	
TIN			Apply directly over zinc immersion coating	
GOLD			Copper strike over zinc as for silver, then plate in conventional bath	
VACUUM PLATING	Exceptionally bright finishes	All alloys	Lacquer, vacuum plate, lacquer for protection	0.001 to 0.002 in.

TABLE 4

CHEMICAL TREATMENTS FOR MAGNESIUM ALLOYS

Dow No.	Treatment		Specification (1)		Alloys on Which Treatment May Be Used	Appearance	Approx. No. of Steps Including Rinse	Approx. Total Time in Treating Bath, Minutes	Uses	Remarks
	Name	Type	MIL Aero	AMS						
1	Chrome-Pickle	Chemical	MIL-M-3171 Type 1	2475	All alloys	Matte gray to yellow red	5	6	General purpose treatment; good paint base	Simple, inexpensive dip treatment; slight dimensional loss
4	Chrome-Alum	Chemical	—	—	Die cast R	Brown-black	6	10	Black decorative finish for die castings	Improves paint adhesion
7	Dichromate	Chemical	MIL-M-3171 Type 3	2475	All commercial alloys except M, EK30A, EK41A and HK31XA	Brown	7	45	Provides best combination of paint base and protective qualities	Does not materially affect dimensions. Requires ½ hour or more in boiling solution
8	Alkaline Dichromate	Chemical	—	—	All commercial alloys except M, EK30A, EK41A and HK31XA	Brown-black	9	45	Used for black finish on all forms. More protective on die castings than #4	Has protective and paint base qualities. Requires boiling in solution ½ hour or more
9	Gelvanic Anodize	Electro-chemical	MIL-M-3171 Type 4	—	All alloys	Black	7	30	Used on Dowmetal M in place of #7 or #8. Also any other non-aluminum-containing alloys not treatable in #7 or #8.	Requires galvanic couple between work and steel tank or steel cathode plates if tank is ceramic lined
10	Sealed Chrome-Pickle	Chemical	MIL-M-3171 Type 2	—	All alloys	Similar to #1	7	35	Alternative for #7 when dimensional loss can be tolerated	Improved protection over #1 due to boiling 30 min in dichromate bath
12	Quartz Anodize	Electro-chemical	—	—	All alloys	Light shades of gray and tan	5 to 8	30	Combines decorative finish with abrasion resistance and protective value	Can be dried. Neutralizing seal gives it paint base equal to #7
14	a-c Anodic	Electro-chemical	—	—	All alloys	Light gray to white	4 to 7	25	Most abrasion resistant when given a neutralizing seal can be painted	Covers flow marks in die cast surface. Should be waxed to prevent amassing
15	Bright Finish for Wrought	Chemical	—	—	Dowmetal FS1, J1, M, O1 and ZK60A	Silvery	5 to 7	10	Decorative finish. Used only on wrought magnesium	Good "shelf life" appearance. Dimensions slightly affected by treatment
16	Bright Finish for castings	Chemical	—	—	Dowmetal C, H, R and AZ91C	Silvery	4 to 7	7	Decorative finish. Used only on magnesium castings	Appearance similar to #15, good "shelf life," slight dimensional change
17	Anodize a-c or d-c	Electro-chemical	—	—	All alloys	Light to dark green	5	5-15	Protective and decorative finish	Best abrasion resistance, best paint base and must constitute Dew treatment
	Mendys (2)	Electro-chemical	MIL-M-3171 Type 3	—	d-c: castings and intricate shapes except on M alloys a-c: FS-1, JS-1, M, all cast alloys	d-c: green a-c: black	10	30	Paint and bonding base. Moderate abrasion and corrosion resistance	Can be dried. Protection higher than some non-electrolytic finishes
	HAE (3)	Electro-chemical	—	—	All alloys	Brown	—	—	Exceptionally high corrosion, abrasion and heat resistance, good insulating properties	Available by permission
	Iridite #18 (4)	Chemical	—	—	All alloys	Light to dark	3-7	15-30 sec	As final finish in absence of abrasion or where surface must be electrically conductive, paint base	Can be dried

(1) MIL Aero—Military Aeronautical Standards.

AMS—Aircraft Material Specifications of SAE.

(2) Consolidated-Vulcan Aircraft Corp. Patent 2,497,034.

(3) Obtain further information from Pima-Dunn Laboratories, Frankford Arsenal, Philadelphia, Pa.

(4) Proprietary brand of Allied Research Products, Inc., Baltimore, Md.

Table courtesy The Dow Chemical Co., Midland, Mich.

TABLE 5

CHEMICAL CONVERSION COATINGS

U. S. Government Specifications

SPECIFICATION NO.	TITLE	TYPE COATING	REQUIREMENTS	APPLICATIONS
MILITARY MIL-C-490A Grade I	Cleaning and Preparation of Ferrous and Zinc Coated Surfaces for Organic Protective Coatings	Phosphate	Adherent film	Base for organic coatings
MIL-F-485A	Finish, Chemical, Black for Copper Alloys	Oxides, sulphides	Weatherometer, 200 hr	Paint-base, corrosion retardant, or decorative coating
MIL-M-3171A Type I Type II Type III Type IV Type V	Magnesium Alloy, Processes for Corrosion Protection of	Chromates, oxides Chrome pickle Sealed chrome pickle Dichromate Galvanic anodizing Caustic anodizing	None, other than visual	Paint base and corrosion protection For temporary storage For prolonged storage For prolonged storage where close tolerances are to be held For permanent protection where close tolerances are to be held For permanent protection
MIL-C-5541C	Chemical Films for Aluminum and Aluminum Alloys	Phosphates, chromates	Salt spray, 168 hr min	Paint base, corrosion preventative film for aluminum
MIL-A-3625A Type I Type II	Anodic Coatings, for Aluminum and Aluminum Alloys	Oxide Chromic acid Sulphuric acid	Salt spray, 240 hr min	Paint-base, corrosion protection under severe conditions
MIL-T-12879 Type I Class 1 Type I Class 2 Type II	Chemical Treatments for Zinc Surfaces	Phosphate Chromate Chromate	Subject to inspection	Paint-base, corrosion protection
MIL-C-12948 Type A Type B Class 1 Type B Class 2	Coatings, Phosphate	Manganese phosphate Zinc phosphate Zinc phosphate with inorganic salt seal	Salt spray, 1 hr Salt spray, 2 hr Salt spray, 24 hr; 40 hr after seal and dye	For high temperature alkaline environments For low temperature alkaline environments Applicable to fire control instruments after sealing and subsequent dyeing
MIL-C-16232A Type I Type II	Coatings, Phosphate Heavy	Manganese base 0.0002-0.0004 in. thick Zinc base 0.0002-0.0005 in. thick	Salt spray, 1.5 hr; Salt spray 24 hr after impregnation Salt spray, 2 hr; Salt spray, 48 hr after impregnation	To prevent wear of bearing surfaces. Must be impregnated
MIL-C-17711	Coatings, Chromate for Zinc Alloy Castings and Hot-Dipped Galvanized Surfaces	Chromate	Salt spray, 96 hr min	Paint base, corrosion protection
ARMY-NAVY AN-QQ-A-696 AN-C-170	Superseded by MIL-A-8625 Superseded by MIL-C-5541			
U. S. ARMY 50-86-11A	Superseded by MIL-T-12879			
U. S. ARMY 57-8-2C	Superseded by various Federal and	Military specifications		
ASTM B-381-55T	Chromate Finishes on Electro-Deposited Zinc, Hot-Dipped Galvanized, and Zinc Die Cast Surfaces	Chromate	Salt spray as specified	None specified
AERONAUTICAL MATERIAL SPECIFICATIONS AMS 2470C	Anodic Treatment for Aluminum Base Alloys	Oxide (chromic acid)	Salt spray, 250 hr min	Paint base, corrosion protection
AMS 2473	Chemical Treatment for Aluminum Base Alloys	Oxide, phosphate, silicate, chromate	Salt spray, 168 hr min	Paint base, corrosion protection
AMS 2474	Chemical Treatment for Aluminum Base Alloys	Silicate, chromate	Salt spray, 168 hr, electrical tests	Paint base, corrosion protection, high electrical conductivity
AMS 2475A	Protective Treatments for Magnesium Base Alloys	Dichromate or chrome pickle	None required	Paint base, corrosion protection
AMS 2486A	Phosphate Treatment	Phosphate	Salt spray, 150 hr after painting	Paint base
AMS 2481B	Phosphate Treatment	Manganese phosphate	Supplementary oil dip	For ferrous bearing surfaces
AMS 2485B	Black Oxide Treatment	Oxide	Supplementary oil dip. 100 pct humidity for 120 hr at 120° F	For ferrous bearing surfaces

Compiled by N. E. Woldman and R. H. Schoemann

TABLE 6

METAL CONDITIONING (SURFACE CLEANING)

U. S. Government Specifications

SPECIFICATION NO.	TITLE	MATERIAL	APPLICATION METHODS	PHYSICAL REQUIREMENTS	PURPOSE
FEDERAL P-C-436a	Cleaning Compound	Hot alkali	Immersion	None required	Hot soak tank cleaning of ferrous and nonferrous parts
P-R-791	Rust Removing Compound	Phosphoric acid	Immersion	Flash point, 135° F min	Removal of rust from ferrous surfaces in presence of light grease and oil
MILITARY MIL-490A Grade II	Cleaning and Preparation of Ferrous and Zinc Coated Surfaces for Organic Protective Coatings	Sand, shot, seed or grit Hot alkali Solvent Alcoholic phosphoric acid Hot phosphoric acid plus detergent Emulsion cleaner	Mechanical blasting Immersion, spray or electrolytic Immersion, spray or vapor Immersion	None required	Cleaning treatments which leave metal surface substantially bare
Type 1 Type 2 Type 3 Type 4 Type 5 Type 6					
MIL-T-704B	Treatment and Painting of Material	Varied, depending on nature of metal surface to be treated	None specified	None required	To specify varied finishing systems depending on the nature of its end use
MIL-S-5002	Surface Treatments for Metal and Metal Parts in Aircraft	Varied, depending on nature of metal surfaces to be treated	None specified	None required	To specify metal surface treatments for aircraft components uncovered by other specifications
MIL-C-5418A	Compound; Cleaner and Brightener, Non-flammable	Phosphoric acid base	Dip and brush	200 hr weatherometer	Cleaner and brightener for bare aluminum surfaces of aircraft
MIL-M-7752	Metal Cleaner	Silicate soap powder	Immersion in water solution	None required	Cleaning of metal surfaces prior to the application of surface coatings
MIL-M-10578	Metal Conditioner and Rust Remover	Phosphoric acid base 3 parts water to 1 part conditioner 3 parts water to 1 part conditioner 2 parts water to 1 part conditioner	Immersion, spray or brush Sponge, rag or brush Immersion, spray or brush	Flash point, 135° F min 65% min free acid, 16% min solvent 20-25% free acid, 25% min solvent 42% free acid and shall contain no inhibitor	Rust and grease remover Rust and grease remover
Type I Type II Type III					
MIL-M-15205A	Metal Conditioning Compound	Petroleum derivatives free from kerosene or essential oils Light Heavy	Dip, brush or spray	Flash point, 200° F min Flash point, 315° F min	To render rust scale more readily removable preparatory to painting
Type I Type II					
MIL-C-18687	Cleaning Compound	Powder Liquid	Immersion in water solution	None required	Cleaning and washing of painted or unpainted aircraft surfaces
Type I Type II					
ARMY 3-212	Superseded by MIL-M-10578				

Compiled by N. E. Woldman and R. H. Schoemann

CLEANING AND PICKLING

TABLE 7

TYPICAL ELECTROLYTIC CLEANING OPERATIONS

METAL	TYPICAL ELECTROLYTE (Per Gal of Water)	VOLTS	CURRENT DENSITY AMP PER SQ FT	TEM- PERATURE °F	TREATMENT TIME, IN MIN	OPERATING DATA
BRASS	Mild alkaline solution	7	10 to 40	200	2	Cathodic, steel anode, and tank
BRASS (to be nickel plated)	4 oz sodium carbonate 2 oz tri-sodium phosphate 12 oz sodium phosphate 1 oz caustic soda	6 to 12	high	175 to 200	Few seconds	Cathodic, steel anode, and tank
LEAD OR TIN	4 oz sodium carbonate and little tri-sodium phosphate	4	10	200 212	1 to 3	Cathodic, steel anode and tank, dip in HCl solution and NaCl
MAGNESIUM	250 g per liter chromic acid 150 g per liter sulphuric acid	6	150 to 500	113	Few seconds	Cathodic, lead anode and tank
MAGNESIUM	25 pct hydrofluoric acid	45	400	Room	10	Cathodic, lead anode and tank
MAGNESIUM	3 oz sodium carbonate 2 oz sodium hydroxide	6	10 to 40	190 212	3 to 10	Cathodic, steel anode and tank
NICKEL	2 oz sodium carbonate 5 oz sodium sesquifluoride 0.5 oz caustic soda	6	15	210	1/12 to 1/2	Cathodic, lead anode and tank, follow by 2 pct sulphuric acid dip
NICKEL	2 oz sodium carbonate	6	10	120	1/12 to 1/2	Cathodic, lead anode and tank, follow by 2 pct sulphuric acid dip
NICKEL	Patent No. 2, 299, 054 Sodium cyanide					Cathodic
STEEL	3 oz caustic soda	6	10 to 50	145	1 to 4 cathodic 1/4 anodic	Agitate work, steel cathode
STEEL	4 to 8 oz caustic soda	4 to 8	20 to 100	180 200	1/4 up	Agitate work, steel cathode
STEEL	4 oz sodium carbonate 2 oz tri-sodium phosphate 1 oz caustic soda	6 to 12	50 to 60	170 to 200	1/2 up	Steel anode, brazed copper bars
STEEL	5 oz sodium sesquifluoride 0.5 oz caustic soda	6 to 12	20 to 100	210	1 to 5	Anodic
STEEL	6 to 10 oz sodium orthosulfate	4 to 8	20 to 100	180 to 210	1 to 2	Cathodic or cathodic-anodic
STEEL	8 oz caustic soda 2 oz sodium orthosulfate	4 to 8	20 to 100	180 to 210	1 to 2	Cathodic or cathodic-anodic
ZINC	0.5 oz tri-sodium phosphate 1.2 oz sodium carbonate	4 to 6	20 to 40	160 180	1/2 to 2	Cathodic, follow by dip in 200 g per liter chromic acid at 212° F
ZINC	4 oz sodium cyanide 2 oz caustic soda 1 oz sodium dichromate	4 to 6	20 to 40	140 to 160	15 to 35	Use wetting agent, reverse current

Modified from data supplied by Colonial Alloys Co., Philadelphia

TABLE 8

TYPICAL IMMERSION CLEANING OPERATIONS

METAL	BATH	TEMPERATURE, °F	TIME, MINUTES	OPERATING DATA
ALUMINUM	3-8 oz/gal Caustic soda	120-180	2-10	Etching cleaner
ALUMINUM	4 oz/gal Metasilicate	160-180	2-10	Non-etching clear
	4 oz/gal Soda ash			
BRASS	4 oz/gal Sodium orthosilicate	160-180	2-5	
	2 oz/gal Soda ash			
COPPER	6-8 oz/gal Sodium orthosilicate	160-210	2-10	
MAGNESIUM	8 oz/gal Sodium orthosilicate	160-210	2-10	
NICKEL	4 oz/gal Sodium orthosilicate	150-210	2-10	
	2 oz/gal Soda ash			
STEEL	8 oz/gal Sodium orthosilicate	180-210	2-10	
STEEL	6 oz/gal Sodium orthosilicate	180-210	2-10	
	2 oz/gal Trisodium phosphate			
STEEL	4 oz/gal Caustic soda	180-210	2-10	
	4 oz/gal Trisodium phosphate			
ZINC	4 oz/gal Metasilicate	140-180	1-5	
	4 oz/gal Soda ash			

Note: These baths are not intended to represent commercial baths, since these may contain soaps, surfactants, water treating chemicals, inhibitors, etc. Rather, these show the basic chemicals which are used in these operations.

TABLE 9

TYPICAL SPRAY CLEANING OPERATIONS

METAL	BATH	TEMPERATURE, °F	MINUTES
ALUMINUM	1/2-1 oz/gal Metasilicate	140-170	1/2-2
	1/2-1 oz/gal Soda ash		
BRASS	1/2-1 oz/gal Sodium orthosilicate	140-170	1/2-2
	1/4-1/2 oz/gal Soda ash		
COPPER	1-2 oz/gal Sodium orthosilicate	140-170	1/2-2
MAGNESIUM	1-2 oz/gal Sodium orthosilicate	140-170	1/2-2
NICKEL	1-2 oz/gal Sodium orthosilicate	140-170	1/2-2
STEEL	1/2-2 oz/gal Sodium orthosilicate	140-180	1/2-2
STEEL	1/2-2 oz/gal Sodium orthosilicate	140-180	1/2-2
	1/4 oz/gal Trisodium phosphate		
STEEL	1/2-2 oz/gal Caustic soda	140-180	1/2-2
	1/2 oz/gal Trisodium phosphate		
ZINC	1/2-1 oz/gal Metasilicate	140-170	1/2-2
	1/2-1 oz/gal Soda ash		

Note: These baths are not intended to represent commercial baths since these may contain soaps, surfactants, defoamers, water treating chemicals, etc. Rather, these show the basic chemicals which are used in these operations.

Tables courtesy Pennsylvania Salt Mfg. Co., Philadelphia

TABLE 10

COMPARISONS OF PICKLING, DEGREASING, CLEANING AND DESCALING

FACTORS	Tumbling	Sand and Shot Blasting	Flame Cleaning	Safety Solvent Degreasing	Chlorinated Solvent Degreasing	Emulsifiable Solvent Degreasing	Chemical and Electro-Chemical Cleaning	Immersion and Electro-Pickling	Scratch Brushing	Ultrasonic Cleaning	Catalyzed Salt Cleaning (Kalsene)	Sodium Hydroxide Descaling (Du Pont)	Virgo Salt Descaling (Hooker)
EQUIPMENT	Horizontal or tilting barrel—20 to 60 rpm	Air blasting, etc., or centrifugal wheels	Oxyacetylene multijet torches	Tanks and/or conveying and spraying equipment	Special vapor-phase degreasing machines	Same as for safety solvents and heat	Revolving barrels may be used (drums)	Tanks, acid lined	Hand brushes or polishing lathes	Ultrasonic generator, transducers, tank	Heated tank, water rinses, D. C.	Salt bath furnace, Acid tubs, Ammonia dissociator	Fused salt bath, tanks, conveying equipment
MEDIUM (solutions or materials)	Steel balls, stars, dugs, or chemicals and soaps	Sand or grit or shot	Oxyacetylene multijet torches	Mineral solvents with flash point over 100° F	Tri- or per-chlorethylene or equal	Mineral solvent mixed with suitable detergents, etc., followed by a hot water treatment.	Generally alkaline solutions	Various acids; see pickling table VIII	Hand brushes or polishing lathes; see scratch brush table XVII	Aqueous solutions of detergents or alkaline cleaners, emulsion cleaners or naphtha	Proprietary Catalyzed Salt Compound	Fused caustic soda containing 1.5-2.8% Sodium Hydroxide. Acid solutions for after treatments	Fused salt, water quench, acid dip
SIZE AND SHAPE LIMITATION	Maximum 10-lb pieces. No interferences	Generally castings all sizes except smallest—must be used after machining	No thin sections; only for large work			All shapes and sizes			Small parts, not for production	Usually small, intricate shapes	All shapes and sizes		
USUAL SUBSEQUENT OPERATION	Plate after pickling	Painting	Painting	Painting or pickling or chemical cleaning, polishing, etc.	Painting	Painting	Painting	Alkaline cleaning	Painting	Plating	Machining, Brazing, Tinning, polishing	Further processing, Finishing	Further fabricating
SURFACE AND METAL EFFECTS	Stress relief may occur. Removes dirt and scale. Dimensional changes	Removes dirt and scale	Removes dirt and scale	No change to metal or surface. Removes oils, greases and removes solid-particle dirt if loosely held.	Removes dirt, greases, and animal oils	Removes dirt, greases, and animal oils	Removes dirt, greases, and animal oils	Removes oxides and scale	Light surface polishing action	Removes acid, scale, oxides, carbon, graphite, oils, etc.	Removes dirt and scale	Removes oxides, scale, dirt, carbon, silicon, etc.	
OPERATING TEMPERATURES	Room, chemical barrel cleaning at elevated temperatures	Room	Extremely high temperature	Room	188° F usually	Room, followed by hot water at 200° F	Generally 140° to 200° F	Room to 180° F	Room	Generally 90° to 160° F	700° to 775° F	700° to 775° F	900° to 1250° F
HEALTH HAZARDS	Safe	Precautions required	None	Slight	Care required	Slight to none	Slight to considerable	Considerable	Slight	Depends on medium used	Precautions required	Care required	Precautions required
FIRE HAZARDS	Safe	None	As hazardous as welding	Fairly safe	Very slight	Fairly safe	None	None	None	Depends on medium used	Similar to other molten baths	None	None
WORKMEN	Semi-skilled	Semi-skilled	Semi-skilled	Unskilled	Semi-skilled	Unskilled	Unskilled	Unskilled	Unskilled	Semi-skilled	Semi-skilled	Semi-skilled	Unskilled
MECHANICAL CLEANLINESS (i. e. oxide and scale removed)	Yes	Yes	Yes	No	No	No	No	Yes if not too heavy	Yes	No	Yes	Yes	Yes
PHYSICAL CLEANLINESS (Oil, grease and solid particles removed)	No	Yes	Yes	Yes	Yes	Yes	Yes, except mineral oils	No	No	Yes	Yes	Yes	Yes
CHEMICAL CLEANLINESS (All acids and dirt and chemical—finger prints)	Mostly	Mostly	No	No	No	No	Yes	No	Mostly	Yes	Yes	Yes	Yes
SUBSEQUENT OXIDATION	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Same as base metal	Carbon steel—yes Stainless steel—no	No

TABLE II

PROPERTIES AND USES OF CHLORINATED SOLVENTS

	CARBON TETRACHLORIDE	ETHYLENE DICHLORIDE	TRICHLOR- ETHYLENE	PERCHLOR- ETHYLENE	PROPYLENE DICHLORIDE	p-DICHLORO- BENZENE	METHYL CHLOROFORM	
FORMULA	CCl ₄	ClCH ₂ CH ₂ Cl	ClCH=CCl ₂	Cl ₃ C-CCl ₃	CH ₃ CHClCH ₂ Cl	1,2-C ₆ H ₄ Cl ₂	CH ₃ CCl ₃	
MOLECULAR WEIGHT	153.84	98.97	131.40	165.85	112.99	147.01	133.42	
BOILING POINT (760 mm.), °C	76.75 170.15	83.4 182.1	86.9 188.4	121.2 250.2	96.2 205.2	180.5 356.9	74.1°C (165.4°F)	
FREEZING POINT, °C	-23.0 -9.4	-35.9 -32.6	-86.4 -123.5	-22.35 -8.2	-100.4 -148.7	-17.0 +1.4	-33.0°C (-27.4°F)	
VAPOR PRESSURE (mm. Hg), 20°C	91.1	66.8	57.8	14.4	39.7	1.1	101 mm. Hg at 20°C	
SPECIFIC GRAVITY, VAPOR (Air = 1)	5.31	3.48	4.54	5.73	3.90	5.07	4.40	
DENSITY, LIQUID (20/4°C) Pounds/Gallon, 20°C (68°F)	1.594 13.30	1.253 10.45	1.464 12.22	1.623 13.53	1.156 9.65	1.306 10.90	1.327 at 20/4°C 11.07 (20°C)	
SOLUBILITY IN WATER g./100 g. water	0.08 (25°C)	0.84 (25°C)	0.11 (25°C)	0.015 (25°C)	0.27 (20°C)	0.0145 (25°C)	—	
SOLUBILITY OF WATER IN SOLVENT g. water/100 g. solvent	0.013 (25°C)	0.16 (20°C)	0.027 (25°C)	0.0105 (25°C)	0.04 (20°C)	—	—	
LATENT HEAT OF VAPORIZATION cal./g. (B.P.) B.T.U./lb.	46.8 84.2	77.3 139.1	57.2 103.6	50.0 90.0	87 121	65 117	—	
SPECIFIC HEAT, LIQUID, 20°C cal./g./°C or B.T.U./lb./°F	0.205	0.208	0.225	0.205	0.22	0.27	0.275 at 20°C	
FLASH POINT (Closed Cup), °F	none	56	none	none	60	151	none	
MAX. ALLOWABLE CONCENTRATION in Air, parts per million**	25	100	200	200	75	50	500	
STABILITY	May be used in the presence of air and light with the common construction materials up to 130°C (266°F). In the presence of undistilled water, carbon tetrachloride hydrolyzes readily, and at its boiling point, wet carbon tetrachloride will corrode most of the common construction metals.	May be used in the presence of air and light with the common construction materials at temperatures up to 100°C (212°F). In contact with water it hydrolyzes slowly at 80°C (176°F).	May be used in the presence of air, water, and light with any of the common construction materials at temperatures up to 120°C (248°F).	May be used in the presence of air, water, and light with any of the common construction materials at temperatures up to 140°C (284°F).	Completely stable in the presence of air, water and light under normal atmospheric conditions. Practically nonflammable. Clear, colorless and pungent.	Completely stable in the presence of air, water and light under normal atmospheric conditions. Practically nonflammable. Clear, colorless and pungent.	Not subject to oxidation in the presence of light. Although there is a tendency to hydrolyze slowly in presence of water at elevated temperatures, this process is negligible. Contact with aluminum should be avoided as this solvent corrodes aluminum excessively. An inhibitor is being sought for the aluminum reaction and may soon be available.	
USES	Degreasing and cleaning metals, textiles, leather; fire-extinguishing fluid; fumigant; in organic syntheses; solvent for fats, oils, waxes, rubber, resins, certain gums, resins, etc.	Cleaning metals, textiles, leather; fumigant; paint removers; in organic syntheses; solvent for fats, oils, waxes, some alkalooids, certain resins, and cellulose derivatives.	Vapor degreasing metals, ceramics; heat-transfer fluid; F. P. depressant; solvent for oils, fats, waxes, alkalooids, rubber, resins; in org. synths.	Drycleaning fluid; vapor-degreasing and drying materials; heat-transfer fluid; F. P. depressant; solvent for oils, fats, waxes, tars, paraffin, gums; in org. syntheses.	In cleaning and spotting mixtures; in organic syntheses; fumigant; insecticide; solvent for oils, fats, waxes, gums, and resins, also some dyes.	Metal cleaners and polishers (dissolves nonferrous oxides); in lacquers and varnishes; preservative, fumigant; in organic syntheses; solvent for oils, waxes, tars, sulfur, resins.	Cold cleaning.	

* "NFPA Handbook of Fire Protection," R. S. Mulliken, National Fire Protection Assoc., 11th Ed. (1954), pp. 295, 302, 314.

** "Threshold Limit Values for 1953," American Conference of Governmental Hygienists, A.M.A. Archives of Industrial Hygiene and Occupational Medicine, Vol. 6, pp. 298-7 (1953).

TABLE
12

INFRARED AND CONVECTION DRYING—TIMES AND TEMPERATURES

MINUTES	LAMP INFRARED INPUT WATTS PER SQ FT*						FORCED CONVECTION AIR TEMPERATURE		
	720		1080		1440		18 ga.		
	18 ga.	12 ga.	18 ga.	12 ga.	18 ga.	12 ga.	300°F	390°F	660°F
1	242°F	156°F	320°F	185°F	460°F	226°F	138°F	235°F	310°F
2	360	225	468	286	556	360	180	308	425
3	428	290	532	370	622	470	212	340	496
4	457	342	562	435	654	538	230	360	540
5	474	385	576	480	668	580	243	370	577
6	482	415	580	500	675	608	254	375	600
7	487	435	584	530	678	630	263	378	620
8	489	450	586	540	679	644	270	380	625
9	492	460	587	550	680	655	275	381	628
10	493	464	587	555	680	662	280	382	630

NOTE: Metal temperatures (approximate) are shown for three moderate infrared intensities and three forced convection oven air temperatures at normal velocity.

* Conventional lamp equipment provides input intensities up to effectively 3000 w per sq ft of product. Resistance type equipment is available up to 4500 w per sq ft. New lamp equipment can provide up to 13500 w per sq ft of product. Theoretically this latter value would approximate the performance of an 1800°F forced convection furnace or kiln.

Tables courtesy The Fostoria Pressed Steel Corp., Fostoria, Ohio

TABLE 13

TYPICAL ORGANIC COATING PROPERTIES

COATING	RESISTANCE TO							Flexural Strength	Adhesion	Toughness	Color Retention
	Heat	Sunlight	Marring	Weak Acids	Mineral Solvents	Water					
NITROCELLULOSE LACQUERS	Clear Pigmented	Poor Poor	Fair Good	Good Good	Poor Poor	Fair Fair	Poor Poor	Good Good	Good Good	Good Good	Fair Good
ALKYD	Clear Pigmented	Fair Fair	Good Excellent	Good Good	Fair Fair	Fair Fair	Good Good	Good Good	Good Good	Good Good	Good Excellent
ALKYD-UREA	Clear Pigmented	Good Good	Good Good	Excellent Excellent	Good Good	Good Good	Good Good	Fair Fair	Good Good	Good Good	Good Good
ALKYD MELAMINE	Clear Pigmented	Good Good	Good Good	Excellent Excellent	Good Good	Good Good	Good Good	Fair Fair	Good Good	Good Good	Excellent Excellent
PHENOL FORMALDEHYDE (heat-setting)	Clear Pigmented	Good Good	Fair Fair	Excellent Excellent	Excellent Excellent	Excellent Excellent	Excellent Excellent	Poor Poor	Fair Good	Good Good	Fair Fair
CHLORINATED RUBBER	Clear Pigmented	Fair Fair	Poor Good	Fair Fair	Good Good	Poor Poor	Good Good	Fair Fair	Good Good	Good Good	Poor Good
SHELLAC	Clear	Fair	Poor	Good	Poor	Good	Poor	Poor	Good	Good	Poor
OIL-BASE PAINTS	Pigmented	Fair	Good	Fair	Poor	Fair	Good	Good	Good	Good	Good
MODIFIED EPOXY (heat-setting)	Clear Pigmented	Good Good	Fair Good	Excellent Excellent	Good Good	Excellent Excellent	Good Good	Excellent Excellent	Excellent Excellent	Excellent Excellent	Fair Good
EPOXY-ESTERS	Clear Pigmented	Good Good	Good Good	Good Good	Good Good	Fair Fair	Good Good	Good Good	Good Good	Good Good	Good Good
VINYLS	Clear Pigmented	Fair Fair	Poor Good	Fair Fair	Good Good	Fair Fair	Fair Fair	Excellent Excellent	Fair Fair	Good Good	Poor Good
SILICONE ALKYD	Clear Pigmented	Excellent Excellent	Excellent Excellent	Excellent Excellent	Good Good	Fair Fair	Good Good	Good Good	Good Good	Good Good	Excellent Excellent

Table courtesy The Vorac Co., Rutherford, N. J.

MECHANICAL FINISHING

TABLE 14

DEBURRING AND FINISHING WITH NON-METALLIC MEDIUMS

METAL	FORM	MEDIUM		COMPOUND†	AMOUNT OF COMPOUND*	WATER*	ROLLING TIME	FINISH
		SIZE	TYPE†					
STEEL (mild)	Stampings Forgings Screw Mach. Parts	1/4 to 1 in. 1/4 to 1 in.	Type I Type II	Class A or B	2-3 lb	1-2 gal	1-6 hr	Matte
		1/4 to 1/2 in. 1/4 to 1/2 in.	Type I Type II	Class D	4-8 oz	4-5 gal	1/2-3 hr	Bright
BRASS BRONZE	Sand Castings	1/2 to 1 in.	Type I	Class A	2-3 lb	1-2 gal	15-25 hr	Matte
		1/6 to 1/2 in.	Type II	Class D	This may be followed with 4-8 oz	4-5 gal	1-3 hr	Bright
BRASS (light burr)	Stampings Screw Mach. Parts	1/8 to 1/2 in.	Type I	Class D	4-8 oz	4-5 gal	1-2 hr	Bright
ALUMINUM	Castings Forgings Stampings	1/2 to 1 in. 1/4 to 3/4 in.	Type II Type I	Class A or B	1-2 lb	2 gal	1-5 hr	Dull to Matte
		1/2 to 1 in. 1/4 to 3/4 in.	Type II Type I	Class B	1-2 lb	2 gal	2-6 hr	Dull
	Forgings Stampings	1/8 to 1/4 in.	Type I	Class D	4-6 oz	4-5 gal	1-3 hr	Bright
NICKEL SILVER	Stampings Forgings	1/4 to 3/4 in. 1/8 to 1/2 in.	Type II Type I	Class B	1/2-2 lb	1-2 gal	1-4 hr	Dull
		1/4 to 3/4 in. 1/8 to 1/4 in.	Type II Type I	Class D	This may be followed with 4-8 oz	4-5 gal	1-2 hr	Bright
ZINC BASE	Castings	1/4 to 3/4 in.	Type II	Class B	1-2 lb	1-2 gal	1-10 hr	Dull
		1/8 to 1/2 in.	Type I	Class D	This may be followed with 4-5 oz	4-5 gal	1-2 hr	Bright
		1/8 to 1/2 in. 1/4 to 3/4 in.	Type I Type II	Class D	4-5 oz	4-5 gal	1/2-1 hr	Bright
STAINLESS STEEL	Stampings	1/4 to 1 in. 1/8 to 3/4 in.	Type I Type II	Class A	1-2 lb	1-2 gal	1-8 hr	Dull
		1/8 to 1/4 in.	Type I	Class D	This may be followed with 4-8 oz	4-5 gal	3-6 hr	Bright

† See accompanying legend.

* Weights and volumes are given per cubic foot of mixed work and medium.

Table courtesy Frederick Gumm Chemical Co., Kearny, N. J.

ROLLING MEDIUM

Basically there are three types of rolling medium used in deburring.

TYPE I—Cutting type—Usually this class is based on aluminum oxide, either natural, fused or bonded. This type has heavy cutting ability and does not tend to glaze easily.

TYPE II—Various stones or ceramic media. This type has mild cutting action for a time and then tends to glaze unless used with an abrasive compound.

TYPE III—Metallic slugs. Zinc or soft steel. These have no cutting action per se but always require the use of abrasive compounds.

COMPOUNDS

CLASS A—Heavy cutting abrasive with various detergents, buffers, etc.

CLASS B—Medium cutting abrasive with various detergents, buffers, etc.

CLASS C—Fine cutting abrasive with various detergents, buffers, etc.

CLASS D—Compound containing no abrasive but only detergents, lubricants, buffers, etc.

TABLE 15 DEBURRING WITH METALLIC MEDIUM

METAL	FORM	COM- POUND†	AMOUNT OF COM- POUND‡	AMOUNT OF WATER‡	ROLLING TIME	FINISH
ALUMINUM	Casting Forging	Class B	1-2 lb	2-3 gal	1-6 hr	Light Matte
		Class C	½-1 lb	2-3 gal	1-3 hr	Dull to glossy
BRASS	Screw Mech. Stamping Machined Castings	Class B	1-2 lb	2-3 gal	2-5 hr	Light Matte
		Class C				
ZINC BASE	Castings	Class B	1-2 lb	2-4 gal	1-3 hr	Light Matte
		Class D	10-12 oz	3 gal	15 min	Bright
STAINLESS STEEL CASE HARDENED STEEL	Stampings Forgings	Class A	1-2 lb	1-3 gal	3-10 hr	Matte
			Tumble flush and follow this with			
		Class B	1-2 lb	1-3 gal	3-12 hr	Dull
		Class C	½-1 lb	1-2 gal	4-10 hr	*High Polish
	Smooth Machined or previously tumbled parts	Class C	1-2 lb	2-4 gal	5-9 hr	Brilliant

† See accompanying legend.

‡ Weights and Volumes are given per cubic foot of work plus medium.

* Maximum brilliance is obtained by a final burnish of 15 minutes to 1 hour.

Table courtesy Frederick Gumm Chemical Co., Kearny, N. J.

RECOMMENDED SIZES OF SHOT AND GRIT

The choice of the proper sized abrasive is a matter of careful appraisal of the type of equipment available, the size and characteristics of the work piece, the type of finish desired, etc. The following table can serve only as a general guide.

DIAMOND GRIT

- G-10 } Cleaning of large grey iron and steel castings—
- G-12 } Electric motor frames, cast gears, pressure tanks.
- G-14 } Cleaning of grey iron, malleable iron and steel cast-
- G-16 } ings of large and medium size.
- } Preparation of surfaces prior to enameling—both
- } tubs, plumbing fixtures.
- G-18 } Cleaning of medium-sized grey iron, malleable and
- G-25 } steel castings and steel forgings and heat treated
- } parts. Preparation of sheet steel for coating. Textile
- } machinery, jobbing foundry work, stove parts, elec-
- } trical control boxes, reclamation of steel drums, auto-
- } motive parts, facing of abrasive wheels.
- G-40 } Cleaning of non-ferrous castings. Finishing of grey
- G-50 } iron castings, steel forgings or heat treated parts.
- } Hardware, tools, ball bearing races, misc. machine
- } components.
- G-80 } Cleaning or finishing of delicate work, ferrous or non-
- G-120 } ferrous.
- G-200 } Rifle parts, needle bearings, drills.

CHILLED SHOT

- SAE 1320 Back up material for molds using "C" process.
- 1110 Burnishing balls in tumbling barrels.
- 930 Special weighting material.
- 780 Cleaning of large steel castings.
- 660 Cleaning of large grey iron castings, steel forgings—
- } motor blocks, axle housings, transmission cases, gate
- } valves, crankshafts, railway equipment.
- 550 Cleaning of grey iron and malleable castings—motor
- } blocks, flywheels, manifolds, brake drums, valves.
- } Peening of aircraft propellers.
- 460 Cleaning of medium-sized grey iron, malleable iron
- } and steel castings and forgings—valve guides, con-
- } veyor parts, agricultural equipment, radiators, textile
- } machines, plumbing fittings.
- 390 Cleaning of grey iron and malleable iron castings—
- } lawn mower parts, switch boxes, run-of-the-mill jobbing
- } foundry work, textile machines.
- 330 Cleaning of small grey iron and malleable iron cast-
- } ings—tools, pump parts, plumbing fittings, textile
- } machinery, small automotive and machine parts.
- } Peening of aircraft engine parts.
- 230 Cleaning of small parts—grey iron, malleable iron,
- } and non-ferrous materials. Peening of flat and coil
- } springs.
- 170 } Cleaning of thin-section pieces—stampings, knife
- 110 } blades, small tools. Peening and cleaning of turbine
- 70 } blades. Cleaning and finishing of non-ferrous parts.

(See next page for shot and grit sizes)

Tables courtesy Harrison Abrasive Div., Metals Disintegrating Co., Elizabeth, N. J.

TABLE 16

CAST SHOT NUMBERS AND SCREENING TOLERANCES

SAE SHOT NO.†	ON SCREEN	PER CENT MAX.	THRU SCREEN	ON SCREEN	PER CENT MAX.	THRU SCREEN	ON SCREEN	PER CENT MIN.	THRU SCREEN	ON SCREEN	PER CENT MAX.	THRU SCREEN	PER CENT MAX.
1320	4	0	—	—	—	4	6	90	6	7	7	7	3
1110	5	0	—	—	—	5	7	90	7	8	7	8	3
930	6	0	—	—	—	6	8	90	8	10	7	10	3
780	7	0	—	—	—	7	10	85	10	12	12	12	3
660	8	0	—	—	—	8	12	85	12	14	12	14	3
550	10	0	—	—	—	10	14	85	14	16	12	16	3
460	10	0	10	12	5	12	16	80	16	18	11	18	4
390	12	0	12	14	5	14	18	80	18	20	11	20	4
330	14	0	14	16	5	16	20	80	20	25	11	25	4
230	18	0	18	20	10	20	30	75	30	35	12	35	3
170	20	0	20	25	10	25	40	75	40	45	12	45	3
110	30	0	30	35	10	35	50	70	50	80	10	80	10
70	40	0	40	45	10	45	80	70	80	120	10	120	10

TABLE 17

CLEANING GRIT NUMBERS AND SCREENING TOLERANCES

SAE GRIT NO.	HIGH LIMIT SCREEN		NOMINAL SCREEN		LOW LIMIT SCREEN		
	GRIT RETAINED, PCT MAX.	SCREEN NO.	GRIT RETAINED, PCT MAX.	SCREEN NO.	GRIT TO PASS, PCT MAX.	SCREEN NO.	
G 10	0	7	80	10	10	12	SCREEN NUMBERS AND APERTURES (INCHES) 4 0.187 20 0.0331 5 0.157 25 0.0280 6 0.132 30 0.0232 7 0.111 35 0.0197 8 0.0937 40 0.0165 10 0.0787 45 0.0138 12 0.0661 50 0.0117 14 0.0555 80 0.007 16 0.0469 120 0.0049 18 0.0394 200 0.0029 325 0.0017
G 12	0	8	80	12	10	14	
G 14	0	10	80	14	10	16	
G 16	0	12	75	16	15	18	
G 18	0	14	75	18	15	25	
G 25	0	16	70	25	20	40	
G 40	0	18	70	40	20	50	
G 50	0	25	65	50	25	80	
G 80	0	40	65	80	25	120	
G 120	0	50	60	120	30	200	
G 200	0	80	55	200	35	325	
G 325	0	120	20	325	—	—	

* Per cent of total sample by weight retained by "on" screen and passed by "thru" screen. Thus 4 (0.187) denotes screen No. 4 with 0.187-in. aperture. Percentages given are the basis of weight as determined by the test procedure for shot.

† The Society of Automotive Engineers' Recommended Practice provides for standard Shot and Grit size numbers. For Cast Shot, this number corresponds with the aperture size of the nominal screen. For Grit, this number corresponds with the number of the nominal screen with the prefix G added.

TABLE 18

POLISHING WHEEL GRIT SIZES

PARTS	POLISHING OPERATION				
	FIRST	SECOND	THIRD	FOURTH	FIFTH
AXES	46	80	120	180*	.....
ALUMINUM, SAND CAST (Inside-Bottom)	36 or 46	.....	.....	.....	.....
ALUMINUM, SAND CAST (Outside)	60 or 80	150	Buff	.....	.....
ALUMINUM, DIE CAST	150*	Buff	.....	.....	.....
ALUMINUM, SHEET	120*	180*	Buff	.....	.....
AUTO BUMPERS	60-90	120	180*	220*	Buff
AUTO HEADLIGHTS	180 or 220*	Buff	.....	.....	.....
BAND SAW STEEL	60-80	120 or 150	.....	.....	.....
BRASS, SAND CAST	60-80*	150 or 180*	.....	.....	.....
BRASS, SHEET	180 or 220*	Buff	.....	.....	.....
ELECTRIC IRONS	80	120*	150*	180 to 240*	.....
GRAY IRON, PICKLED	80	120 or 150	.....	.....	.....
GRAY IRON, NOT PICKLED	70	120 or 150	.....	.....	.....
HAMMER HEADS	46 or 60	100 or 120*	.....	.....	.....
KNIVES, TABLE AND STEEL BLADES	120 or 150*	(180 double header 240 machine)	Buff	.....	.....
KNIVES, TABLE, BACKS	46 or 60	.....	.....	.....	.....
KNIVES, MACHETE, EDGES	46 or 60	.....	.....	.....	.....
KNIVES, MACHETE, FACES	80	120*	.....	.....	.....
LOCOMOTIVE SIDE RODS	36	60	120	.....	.....
MONEL METAL, DEEP DRAWN	120	150	180*	Buff	.....
MONEL METAL, CAST	80	120	150	180*	Buff
MONEL METAL, FULL FINISH SHEET	150	180*	220*	Buff	.....
PLOWS	24	80	150	220*	.....
PLOWSHARES	36 or 46	.....	.....	.....	.....
PLOW DISCS	36 or 46	80	.....	.....	.....
SHEARS, TINSMITH	46	80	120	180	.....
SHOVELS, BLADES	36 or 46	120	.....	.....	.....
SHOVELS, STRAPS	36-60	120	.....	.....	.....
STAINLESS STEEL, MIRROR FINISH	60-80	100-120*	150*	220 or 3F*	Buff
STAINLESS STEEL, COMMERCIAL FINISH	80	100*	120*	150*	.....
WRENCHES	36 or 46	80	120*	.....	.....

NOTE: These recommendations are merely a guide and may vary somewhat under varying conditions. Grit sizes above are based on use of glue as a bonding agent. If wheels are set up with cold cement, one grit size finer is generally recommended. The abrasive is aluminum oxide.

* Denotes grease or oil wheel.

Table courtesy Norton Co., Worcester, Mass.

TABLE 19

HOW TO SELECT POWER BRUSHES

For Jobs Requiring Surface Finish Less Than 30 Microinches rms			For Jobs Which Permit or Require Surface Finish Exceeding 30 Microinches rms*		
Brush Flexibility Rating Medium High High			Brush Flexibility Rating Low Medium High		
Brush Surface Finishing Ability Very Fine Fine Medium			Brush Surface Finishing Ability Fine Medium Coarse		
Brush Action Strength Medium Fast Very Fast			Brush Action Strength Fast Medium Very Fast		
Cord and Fabric Brushes	Tampico and Treated Tampico Brushes	Fine Wire Sections Used with Burring Compound	Wire Wheels	Wire Sections	Coiled Knot Sections
MAJOR BRUSH CHARACTERISTICS					
Fast cutting medium flexible wheels. Used with cut and color buffing compounds for producing low microinch finishes	Flexible, fast working wheels. Used with burring compounds of tacky composition for producing surface finishes of approx. 8 to 10 microinches rms	For efficient use of wire brushes with compound, select brushes having medium or high density and fine wire size (0.008 in. or finer)	Wide face, dense fill. Used where fast cutting and fine finishes are required. Best general purpose wire brush	Narrow face, medium density. Used where medium brush flexibility is essential to follow contoured surfaces	Narrow face, low density. Used where a high degree of brush flexibility is needed and where surface impact action is necessary, especially to remove surface encrustations
MAJOR APPLICATIONS IN ORDER OF GENERAL USAGE					
1. Cut and color buffing 2. Surface blending 3. Light scale removal 4. Producing surface juncture blends 5. Burr removal	1. Burr (small) removal 2. Producing radii 3. Light scale removal 4. Surface blending 5. Cleaning 6. Satin finishing	1. Burr (medium) removal 2. Light scale removal 3. Satin finishing 4. Producing radii	1. Burr (heavy) removal 2. Producing radii 3. Rust and oxide removal 4. Scale removal 5. Cleaning 6. Surface blending	1. Cleaning 2. Medium scale removal 3. Rust and oxide removal 4. Satin finishing 5. Surface blending 6. Burr removal	1. Heavy scale removal 2. Rust and oxide removal 3. Satin finishing 4. Producing radii 5. Burr removal (on very hard metals)
CORRECTIONS SUGGESTED					
Brush works too slowly	Brush works too fast	Action of brush peens burr to adjacent surface	Finer or smoother finish required	Finish too smooth and lustrous	Brushing action not sufficiently uniform
1. Increase surface speed by increasing OD or rpm 2. Decrease trim length and increase fill density 3. Increase filament diam	1. Reduce surface speed by reducing rpm or OD 2. Reduce filament diam 3. Reduce fill density 4. Increase trim length	1. Decrease trim length and increase fill density 2. If wire brush tests indicate metal too ductile (burr is peened rather than removed), change to nonmetallic brush such as a treated Tampico used with burring compound	1. Decrease trim length and increase fill density 2. Decrease wire diam 3. Try treated Tampico or cord brushes with suitable compounds at recommended speeds 4. Use auxiliary buffing compound with brush	1. Increase trim length 2. Reduce brush fill density 3. Reduce surface speed 4. Increase filament diam	1. Increase trim length and decrease fill density 2. Devise hand held or mechanical fixture or machine which will avoid irregular off-hand manipulation

* For very ductile metals see Adjustments Column.

Table courtesy The Osborn Mfg. Co.

RUST PREVENTIVES

TABLE 20

RUST PREVENTIVES, U. S. Government Specifications

SPECIFICATION NO.	FILM TYPE	METHODS OF APPLICATION	USES	PHYSICAL REQUIREMENTS	EXPOSURE REQUIREMENTS
MIL-L-644A	Lubricating oil, preservative	Dye or dip	Lubrication and protection of small arms and fuse mechanisms	Flash point, 275°F min	100% humidity for 200 hr at 120°F
MIL-C-972	Superseded by MIL-C-16173A				
MIL-L-3150	Lubricating oil, preservative	Dip or wipe	Lubrication and protection of ferrous and nonferrous metals	Four point, 20°F max	100% humidity for 300 hr at 120°F, 48 hr salt spray
MIL-L-3583	Lubricating oil, preservative	Dip or wipe	Lubrication and protection of metals	Flash point, 300°F min	100% humidity for 200 hr at 100°F
MIL-C-5545A	Compound, oil	Immersion	Aircraft engine preservative	Flash point, 350°F min	One year storage stability, 100% humidity for 30 days at 120°F
MIL-B-6030	Barrier material, stripable and sprayable	Spray	Protection of an entire aircraft	550 psi min tensile strength, 150% min elongation, 40-2 mils thick	144 hr weatherometer, 100% humidity for 240 hr at 120°F, 168 hr salt spray, 168 hr at 168°F
MIL-O-4083A	Hydraulic preservative oil	Immersion	Preservation of hydraulic equipment	Flash point 200°F min	100% humidity for 100 hr at 120°F
MIL-C-6529A Type I	Compound Concentrate	Blending 25% with lubricating oil to obtain Type II	Oil additive	Flash point, 400°F min	One year storage stability, 50 hr engine endurance test
Type II	Blend	Immersion	Reciprocating aircraft engine oil	Flash point, 400°F min	100% humidity for 14 days
Type III	Blend	Immersion	Jet engine oil, aircraft	Flash point, 400°F min	
MIL-C-6704	Superseded by MIL-C-11796A and MIL-C-16173A				
MIL-C-7853	Superseded by MIL-C-6529A				
MIL-C-8188B	Turbine oil	Immersion	Preservation of jet engines	Flash point, 350°F	One year storage stability, 100% humidity 6 days at 120°F, 20 hr engine endurance test
Grade A	High temperature			12-35% swelling of rubber	
Grade B	Low temperature			12-40% swelling of rubber	
MIL-R-10036A	Compound, rust arresting	Spray, brush or dip	For touching up rusted areas on equipment	Flash point, 100°F min	300 hr weatherometer
MIL-C-11796A Class 1	Petrolatum, hot application	Brush or hot dip below 200°F	Highly finished surfaces and small metal parts	Flash point, 350°F min	Weatherometer for 15 days, 1 yr outdoors
Class 1A	Hard film, non-slick	Brush or hot-dip below 200°F	Highly finished surfaces and small metal parts	Melting point 155°F min	Weatherometer for 15 days, 1 yr outdoors
Class 2	Medium film	Brush or hot-dip below 190°F	Outdoor storage and packaging in moderate climates	Melting point 155°F min	Weatherometer for 15 days, 1 yr outdoors
Class 3	Soft film	Brush or hot-dip below 180°F	Packaging of bearings and inaccessible machined surfaces	Melting point 150°F min	Weatherometer for 15 days, 1 yr outdoors
MIL-I-13811A	Compound, electrical insulation	Brush, dip or spray	Protection of electrical circuits against moisture and corrosion	Melting point 135°F min	100% humidity for 30 days at 120°F, 1 yr outdoor shed
MIL-C-15074A	Compound, fingerprint remover	Dip	Fingerprint removal and temporary protection	Flash point, 75°F min	6-month outdoor storage, 96 hr salt spray
MIL-P-15143	Protective coating	Optional	Heat-hardening phenol formaldehyde coating	Flash point, 100°F	6-month stability, 100% humidity for 7 days
MIL-C-15167A	Compound, petrolatum, pigmented	Hot dip or brush at 190°F	Steel plates for bilges or foundations	Flash point, 60°F min	600 hr weatherometer
MIL-C-16173A Grade I	Compound, solvent cutback	Brush and spray	Maximum outdoor weather exposure	Flash point, 450°F min	None specified
Grade 1A	Hard film	Brush	Limited outdoor weather exposure	Flash point, 100°F min	Weatherometer 1200 hr min, 1 yr outdoor exposure, 14 days salt spray
				Melting point, 175°F min	1 yr outdoor exposure
				Melting point, 150-160°F	

RUST PREVENTIVES, U. S. Government Specifications (Continued)

SPECIFICATION NO.	FILM TYPE	METHODS OF APPLICATION	USES	PHYSICAL REQUIREMENTS	EXPOSURE REQUIREMENTS
Grade 2	Soft film	Brush or spray	Exclusive indoor protection of metal parts		100% humidity for 30 days, 7 days salt spray, 1 yr shed storage
Grade 3	Soft film, water displacing	Brush and spray	Limited indoor protection and to displace water from corroding surfaces		100% humidity for 30 days, 6-month shed storage
MIL-C-16555A	Coating, solution, strippable	Spray type	Metal packaging and protection	Elongation 230% min, tensile index 9.3 max	Salt spray 240 hr min, 1 yr outdoor exposure
MIL-L-28389	Lacquer, strippable	Spray or dip	Coating, general purpose black protective coating	Coating to withstand -50° F to +160° F	150 hr salt spray, 240 hr weatherometer
MIL-L-21240 Grade 1 Grade 2 Grade 3	Lubricating oil preservative Light Medium Heavy	Immersion	Preservative type engine oil	Flash point, 360° F min Flash point, 390° F min Flash point, 400° F min	100% humidity for 200 hr
MIL-P-3428	Packaging papers treated with volatile corrosion inhibitor	Rolls sheets, bags, boxes, etc.	Rust preventive prolonged outdoor, indoor storage, inter-plant protection	Various weight papers and laminations with 2 gr. VCI per sq ft; pH 6.0-8.0	No visible evidence of corrosion on steel panels in 12-month exposure
MIL-P-8574A	Packaging proceedings with VCI paper	Rolls sheets, bags, boxes, etc.	Rust preventive prolonged outdoor, indoor storage, inter-plant protection	Unit packaging per MIL-P-116 for overseas and domestic shipment	Tests for protection: quick leak, vacuum, pressure
JAN-P-115	Compound sealing	Dip	Sealing of wrappings or packages	Softening point, 145° F min	None required
JAN-C-1490 Type I Type II	Compound, strippable	Hot dip	Packaging small parts	350 psi min tensile strength, 50% min elongation 300 psi min tensile strength, 70% min elongation	100% humidity for 720 hr, ten 24-hr hot-cold cycles
<div>ARMY-NAVY SPECIFICATIONS</div> <div>AN-C-52b Superseded by MIL-C-6708 AN-C-117 Superseded by JAN-C-149 AN-C-124a Superseded by MIL-C-11796A and MIL-C-16173A AN-C-125 Superseded by JAN-P-115 AN-VV-C-576b Superseded by MIL-C-7853</div> <div>ARMY SPECIFICATIONS</div> <div>2-82C Superseded by MIL-C-11796 and MIL-C-6708 2-84B Superseded by MIL-C-11796 2-120 Superseded by MIL-L-644A 2-121 Superseded by MIL-C-11796 2-122 Superseded by MIL-L-3150 3-182 Superseded by MIL-C-13811</div> <div>ARMY ORDNANCE SPECIFICATIONS</div> <div>AXS 1001 Superseded by MIL-C-11796A and MIL-C-16173A AXS 1167 Superseded by JAN-C-149 AXS 1347 Superseded by MIL-C-11796 AXS 673 Superseded by MIL-C-16173A</div> <div>NAVY SPECIFICATIONS</div> <div>14-O-17 Superseded by MIL-L-3150 52C17 Superseded by MIL-C-15167 52C18 Superseded by MIL-C-972 52C30 Superseded by JAN-C-149</div> <div>NAVY ORDNANCE SPECIFICATIONS</div> <div>OS 1363 Superseded by MIL-L-3150</div>					
AMS 3065B	Compound, thin film	Dip, spray or brush	Temporary protection	Flash point, 100° F min; 0.001 in. min thick	Humidity 168 hr min at 100% and 120° F
AMS 3071	Concentrate	Blending 25% with lubricating oil	Aircraft engine oil additive	Flash point, 350° F min	100% humidity 150 hr min at 120° F
AMS 3072B	Concentrate	Blending 25% with lubricating oil	Aircraft engine oil additive	Flash point, 350° F min	100% humidity 150 hr min at 120° F
AMS 3075B	Compound, hard film	Dip 170-210° F	Storage or shipment in all climates	Melting point, 150-170° F. Flash point, 350° F min	Humidity 28 days min, salt spray 7 days min
AMS 3076A	Compound, hard film	Dip, spray or brush	Storage or shipment in all climates	Melting point, 150° F min	Humidity 28 days min, salt spray 7 days min
AMS 3079A	Compound, soft film	Dip	Storage or shipment in all climates	Melting point, 125-150° F, flash point, 350° F min, 0.001-0.002 in. thick	Humidity 30 days min, salt spray 14 days min
AMS 3079A	Compound, soft film	Dip, 160-170° F	Storage or shipment in all climates	Melting point, 125-150° F, flash point, 350° F min, 0.001-0.002 in. min	Humidity 30 days min, salt spray 14 days min

Compiled by N. E. Woldman and R. H. Schoemann

Compiled by N. E. Woldman and R. H. Schoemann

PLATING PROCESSES

TABLE 21

METALLIC COATINGS U. S. Government Specifications

SPECIFICATION NO.	TITLE	COATING CHARACTER	THICKNESS IN INCHES	FINISH	SALT SPRAY TEST REQUIREMENTS
QQ-C-320 Class 1, Type I Type II Class 2	Chromium plating	Electrodeposited Decorative Decorative Engineering	0.00001" min 0.00001" min 0.002" min	Bright Satin Plated to dimension or ground after plating	None
QQ-N-290 Class 1, Type I Type II Type III Type IV Type V Type VI Type VII Type VIII Type IX Type X Class 2	Nickel plating	Electrodeposited Decorative, Cu + Ni Copper + nickel Copper + nickel Copper + nickel Nickel Nickel Nickel Copper + nickel Copper + nickel Copper + nickel Engineering	0.002" min 0.00125" min 0.00075" min 0.0004" min 0.0005" min 0.0003" min 0.0001" min 0.00125" min 0.00075" min 0.0005" min 0.003" min	Bright or Matte On steel base On steel base On steel base On steel base On copper alloy base On copper alloy base On copper alloy base On zinc alloy base On zinc alloy base On zinc alloy base Plated to dimension or machined after plating	None
QQ-P-416 Type I, Class A Class B Class C Type II, Class A Class B Class C Type III, Class A Class B Class C	Cadmium plating	Electrodeposited	0.0005" min 0.0003" min 0.0002" min 0.0005" min 0.0003" min 0.0002" min 0.0005" min 0.0003" min 0.0002" min	None None None Chromate Chromate Chromate Phosphate Phosphate Phosphate	240 hr min 192 hr min 96 hr min 336 hr min 288 hr min 192 hr min 240 hr min 192 hr min 96 hr min
QQ-S-365 Type I Type II Type III	Silver plating	Electrodeposited	0.0005" min	Matte Semi-bright Bright	None
QQ-Z-325 Type I, Class 1 Class 2 Class 3 Type II, Class 1 Class 2 Class 3 Type III, Class 1 Class 2 Class 3	Zinc plating	Electrodeposited	0.001" min 0.0005" min 0.0002" min 0.001" min 0.0005" min 0.0002" min 0.001" min 0.0005" min 0.0002" min	None None None Chromate Chromate Chromate Phosphate Phosphate Phosphate	192 hr min 96 hr min 36 hr min 96 hr min 96 hr min 96 hr min 192 hr min 96 hr min 36 hr min
MIL-M-4874	Metal spraying, process for	Material as specified	0.002-0.060" depending on material and application	Light abrasion required. Aluminum surfaces to be dichromated	
MIL-T-10727 Type I Type II	Tin plating	Electrodeposited Hot-dipped	As specified As specified	Lustrous Lustrous	24 hr min 24 hr min
MIL-Z-17871	Zinc coating	Hot-dip galvanizing	0.003-0.0046"	Bright	None
MIL-P-58214 Type I Type II	Chromium plating (porous) Channel Pin-point	Electrodeposited Channel Pin-point	0.005" min radial 0.005" min radial	Ground, bared 20-50% porosity 20-50% porosity	None
AMS 2400K -1 -2 -3 -4 -5	Cadmium plating	Electrodeposited	0.0001" min 0.0002" min 0.0003" min 0.0004" min 0.0005" min	Immersion Chromic acid Chromic acid Chromic acid Chromic acid	100 hr min 150 hr min 200 hr min 225 hr min 250 hr min
AMS 2402D -1 -2 -5	Zinc plating	Electrodeposited	0.0001" min 0.0002" min 0.0005" min	None specified	100 hr min 150 hr min 200 hr min
AMS 2403C	Nickel plating	Electrodeposited	As specified	None specified	When plating is 0.0005 in. min 48 hr are required
AMS 2404B	Chromium plating, hard	Electrodeposited	As specified	700 Ydk min	None
AMS 2407A	Chromium plating, porous	Electrodeposited	0.004-0.006"	45 to 90 micro-inch, rms.	None
AMS 2408A	Tin plating	Electrodeposited	As specified	None	None
AMS 2409A	Tin plating, immersion	Chemical deposition	None specified	Bright gray	None
AMS 2410B	Silver plating	Electrodeposited nickel strike	As specified	High bake	None

METALLIC COATINGS U. S. Government Specifications (Continued)

SPECIFICATION NO.	TITLE	COATING CHARACTER	THICKNESS IN INCHES	FINISH	SALT SPRAY TEST REQUIREMENTS
AMS 2412B	Silver plating	Electrodeposited copper strike	As specified	Low bake	None
AMS 2414A	Lead plating	Electrodeposited	As specified	None specified	None
AMS 2415B	Lead and indium plating	Electrodeposited, weight ratio of indium to lead to be 5.5-8.9%	As specified	Bake at 340-350°F for 2 hr	None
AMS 2416A	Nickel-cadmium plating, diffused	Electrodeposited	0.0002-0.0004" nickel 0.0001-0.0002" cadmium	Chromate immersion, bake at 630°F for 1/2 hr min	100 hr min
AMS 2418A	Copper plating	Electrodeposited	As specified	None specified	None
AMS 2450B	Sprayed metal finish	Aluminum on various base metals	None specified	None specified	250-500 hr depending on configuration
ASTM A-123-S3	Hot galvanized on steel	Zinc; hot galvanized	0.0034" min	Bright	None required
ASTM B-141-S5 Type FC Type FC Type KC Type QC Type QC	Electrodeposited coating, nickel, chromium, on copper and copper alloys	Electrodeposited nickel or chromium Nickel Chromium (if required) Nickel Chromium (if required) Nickel Chromium (if required)	 0.0005" min 0.0001" min 0.0003" min 0.0001" min 0.0001" min 0.0001" min	Bright or dull as specified	None required
ASTM B-142-S5 Type FZ Type KZ Type QZ	Electrodeposited coatings of nickel and chromium on zinc and zinc-base alloys	Electrodeposited nickel or Chromium Cu plus Ni Copper Nickel Cr if required Cu plus Ni Copper Nickel Cr if required Cu plus Ni Copper Nickel Cr if required	 0.00120" min 0.00020" min 0.00050" min 0.00010" min 0.00075" min 0.00020" min 0.00030" min 0.00018" min 0.00050" min 0.00020" min 0.00030" min 0.00010" min	Bright or dull as specified	None required None required None required
ASTM A-153-S3	Zinc coating (hot-dip) on iron and steel	Zinc, hot-dipped	From 0.0017 to 0.0034" min	None specified	None required
ASTM A-164-S5 Type GS Type LS Type RS	Electrodeposited coating of zinc on steel	Zinc, electrodeposited Zinc Zinc Zinc	 0.001" min 0.0005" min 0.00015" min	None specified	None required
ASTM A-165-S5 Type NS Type OS Type TS	Electrodeposited coatings of cadmium on steel	Cadmium, electrodeposited Cadmium Cadmium Cadmium	 0.0005" min 0.0003" min 0.00015" min	Bright or dull as specified	None required
ASTM A-166-S5T Type DS Type FS Type KS Type QS	Electrodeposited coatings of nickel and chromium on steel	Nickel and chromium, electrodeposited Cu plus Ni Final nickel Cr if required Cu plus Ni Final nickel Cr if required Cu plus Ni Final nickel Cr if required Cu plus Ni Final nickel Cr if required	 0.0020" min 0.00100" min 0.000010" min 0.0012" min 0.00000" min 0.000010" min 0.00075" min 0.00040" min 0.000010" min 0.00040" min 0.00020" min 0.000010" min	Bright or dull as specified	None required
ASTM B-268-S5T Type ES Type MS Type PS Type EES Type MMS Type PPS	Electrodeposited coatings of lead on steel	Lead and/or copper Lead Lead Lead Copper Lead Copper Lead Copper Lead	 0.0010" min 0.00050" min 0.00025" min 0.000015" min 0.0010" min 0.000015" min 0.00050" min 0.000015" min 0.00025" min	None specified	None required
ASTM B-253-S3	Electroplating on aluminum alloys	Zinc immersion, copper strike; brass, cadmium, copper, chromium, gold; Nickel plating Silver plating Tin plating Zinc plating	0.3 mil max 0.3-0.5 mil (1-2 mil when corrosion conditions require)	None specified	None required
ASTM B-254-S3	Electroplating on stainless steel	Nickel, Cadmium Copper, Brass, Gold, Silver, Chromium	None specified	None specified	None required

Compiled by N. E. Woldman and R. H. Schoemann

SPECIFICATION PLATING

CADMIUM

Cd++

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	58	1-56	2-54	3-52	4-50	5-48	6-46	7-44	8-42	9-40	19-20	29-0
5	12	23	35	46	58	1-10	1-21	1-33	1-44	1-56	3-52	5-48
10	6	12	17	23	29	35	41	46	52	58	1-18	1-18
15	4	8	12	16	20	23	27	31	35	39	1-18	1-18
20	3	6	9	12	15	18	21	23	26	29	38	1-18
25	2	5	7	9	11	14	16	18	21	23	47	1-18
30	2	4	6	8	10	12	14	16	17	19	39	58
35	2	3	5	7	8	10	12	13	15	16	33	42
40	1	3	4	6	7	9	10	12	13	15	29	44
45	1	3	4	5	7	8	9	10	12	13	26	39
50	1	2	3	5	6	7	8	9	10	11	23	34
gm. per sq. ft.	2.02	4.04	6.06	8.08	10.10	12.12	14.14	16.16	18.18	20.19	40.38	60.57
oz. per sq. ft.	0.07	0.14	0.21	0.29	0.36	0.43	0.50	0.57	0.64	0.71	1.42	2.13

CHROMIUM

6+

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	5-4	10-8	15-12	20-16	25-20	30-24	35-28	40-32	45-36	50-36	101-12	151-48
5	1-1	2-2	3-2	4-3	5-5	6-6	7-7	8-8	9-9	10-9	20-18	30-27
10	31	1-2	1-33	2-4	2-35	3-6	3-37	4-8	4-39	5-4	10-8	15-12
15	20	40	1-1	1-21	1-42	2-1	2-22	2-42	3-2	3-22	6-44	10-6
20	15	30	45	1-0	1-16	1-31	1-46	2-1	2-16	2-32	5-4	7-36
25	12	24	36	49	1-1	1-13	1-25	1-37	1-49	2-1	4-3	6-4
30	10	20	30	40	51	1-1	1-11	1-21	1-31	1-41	3-22	5-3
50	6	12	18	24	31	37	43	49	55	1	2	3
75	4	8	12	16	20	24	28	32	36	40	1-21	2-1
100	3	6	9	12	15	18	21	24	26	30	1-1	1-31
150	2	4	6	8	10	12	14	16	18	20	40	1-1
175	2	3	5	7	9	10	12	14	15	17	35	52
200	2	3	5	6	8	9	11	12	14	15	30	46
gm. per sq. ft.	1.63	3.26	4.88	6.51	8.15	9.76	11.40	13.01	14.65	16.32	32.64	48.92
oz. per sq. ft.	0.058	0.12	0.17	0.23	0.29	0.35	0.40	0.46	0.52	0.58	1.15	1.73

Electrochemical equivalent = 0.0000898.
Density = 6.92.
Weight = 0.00254 × 929.088 × 6.92 = 16.32 gm.
16.32 divided by 0.0000898 = 181998 sec. = 3033 min. = 50.5 hr.

BRASS

70-30

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.002	0.003
1	59	1-59	2-58	3-57	4-56	5-55	6-55	7-54	8-54	9-53	19-46	29-39
5	12	24	36	47	59	1-11	1-23	1-35	1-47	1-59	3-57	5-56
10	6	12	18	24	30	36	42	47	53	59	1-59	2-58
15	4	8	12	16	20	24	28	32	36	40	1-20	1-59
20	3	6	9	12	15	18	21	24	27	30	1-40	1-29
25	2	5	7	9	12	14	17	19	21	24	47	1-11
30	2	4	6	8	10	12	14	16	18	20	40	59
35	2	3	5	7	9	10	12	14	15	17	34	51
40	1	3	4	6	7	9	10	12	13	15	30	45
45	1	3	4	5	7	8	9	10	12	13	26	39
50	1	2	4	5	6	7	8	9	11	12	23	35
gm. per sq. ft.	2.00	4.00	6.00	8.00	10.01	12.01	14.01	16.02	18.02	20.02	40.04	60.06
oz. per sq. ft.	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.57	0.64	0.71	1.42	2.11

Zn++ + 0.000339 × 30 per cent = 0.0001017
Cu + 0.0006588 × 70 per cent = 0.0004612

Electrochemical equivalent 0.0005629
Density = 8.5
Weight = 0.00254 × 929.988 × 8.5 = 20.02 gm.
20.02 divided by 0.0005629 = 35,560 sec. = 593 min. = 9.88 hr.

NICKEL OR COBALT

Ni++
Co++

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	1-53	3-47	5-41	7-34	9-20	11-12	13-4	14-50	16-48	18-52	37-44	56-36
5	22	45	1-7	1-30	1-52	2-15	2-37	2-59	3-21	3-42	7-24	11-6
10	11	26	34	45	57	1-8	1-19	1-30	1-42	1-53	3-46	5-39
15	7	15	23	30	38	45	53	1	1-8	1-15	2-31	3-46
20	6	11	17	23	28	34	40	45	51	56	1-53	2-50
25	5	9	14	18	23	27	32	36	41	45	1-31	2-16
30	4	7	11	15	19	23	26	30	34	38	1-15	1-53
35	3	6	10	13	16	19	23	26	29	32	1-5	1-37
40	3	6	8	11	14	17	20	23	25	28	57	1-25
45	3	5	8	10	13	15	18	20	23	25	50	1-15
50	2	5	7	9	11	14	16	18	20	23	45	1-8
gm. per sq. ft.	2.06	4.12	6.18	8.25	10.31	12.38	14.45	16.50	18.55	20.61	41.22	61.83
oz. per sq. ft.	0.071	0.15	0.218	0.29	0.36	0.44	0.51	0.58	0.66	0.73	1.46	2.18

Electrochemical equivalent (Ni++ +) = 0.0003054 gm. per coulomb.
(Co++ +) = 0.0003040 gm. per coulomb.
As there is only 3 per cent difference all calculations are based on Ni.
Density = 8.75.
Weight = .00254 × 929.088 × 8.75 = 20.61.
20.61 divided by 0.0003054 = 67,520 sec. = 1132 min. = 18.8 hr.

COPPER

Electrochemical equivalent = 0.0003294 gm. per coulomb.

Cu ++

Electrochemical equivalent = 0.0003083 gm. per coulomb.

TIN

C.D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	1.47	3.34	5.21	7.8	8.55	10.44	12.30	14.15	16.2	17.48	35.36	53.24
5	21	42	1.4	1.25	1.47	2.8	2.29	2.50	3.12	3.47	7.8	10.42
10	11	21	32	43	53	1.4	1.15	1.26	1.36	1.44	3.34	5.21
15	15	17	14	21	28	36	43	50	57	1.4	1.1	2.22
20	20	5	11	16	21	27	32	37	43	48	53	1.47
25	25	4	9	13	17	21	26	30	34	39	43	1.26
30	30	4	8	11	14	18	21	25	29	32	36	1.12
35	35	3	6	9	12	15	18	21	24	28	31	1.2
40	40	3	5	8	11	13	16	19	21	24	27	54
45	45	2	5	7	10	12	14	17	19	21	24	48
50	50	2	4	6	9	11	13	15	17	19	21	43
gm. per sq. ft.	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80	18.90	21.00	42.00	63.00
oz. per sq. ft.	0.07	0.15	0.22	0.29	0.36	0.44	0.51	0.59	0.66	0.74	1.47	2.20

Sn +++ +

C.D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	1.33	3.6	4.39	6.12	7.45	9.18	10.51	12.24	13.57	15.28	30.56	46.24
5	19	37	55	1.14	1.33	1.51	2.9	2.28	2.46	3.5	6.11	9.17
10	10	19	28	37	46	56	1.5	1.14	1.24	1.33	3.5	4.38
15	15	6	12	19	25	31	38	44	50	57	1.3	2.5
20	20	5	14	19	23	28	32	37	42	46	1.33	2.19
25	25	4	7	11	15	19	22	26	30	33	37	1.14
30	30	3	6	9	12	15	19	22	25	28	31	1.2
35	35	3	5	8	11	13	16	19	21	24	26	53
40	40	2	5	7	9	12	14	16	19	21	23	46
45	45	2	4	6	8	10	12	14	17	19	21	41
50	50	2	4	6	7	9	11	13	15	17	19	37
gm. per sq. ft.	1.72	3.44	5.16	6.88	8.60	10.32	12.03	13.75	15.49	17.20	34.40	51.60
oz. per sq. ft.	0.06	0.12	0.18	0.24	0.30	0.37	0.43	0.49	0.55	0.61	1.21	1.82

COPPER

Electrochemical equivalent = 0.0006588.

Cu +

Electrochemical equivalent = 0.0006166 gm. per coulomb.

TIN

C.D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	53	1.47	2.41	3.35	4.29	5.22	6.16	7.10	8.4	8.54	17.49	26.42
5	11	21	32	43	54	64	75	86	97	108	216	324
10	5	11	16	22	27	32	38	43	49	54	1.48	2.42
15	4	7	11	14	18	21	25	28	32	36	1.12	1.48
20	3	5	8	11	13	16	19	21	24	27	54	1.21
25	2	4	6	9	11	13	15	17	19	21	43	1.3
30	2	4	5	7	9	11	12	14	16	18	36	54
35	2	3	5	6	8	9	11	12	14	15	30	46
40	2	3	4	5	7	8	9	11	12	13	26	40
45	1	2	4	5	6	7	8	9	11	12	23	35
50	1	2	3	4	5	6	7	8	9	10	21	32
gm. per sq. ft.	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80	18.90	21.00	42.00	63.00
oz. per sq. ft.	0.07	0.15	0.22	0.29	0.36	0.44	0.51	0.59	0.66	0.74	1.48	2.22

Sn ++

C.D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	46	1.33	2.19	3.5	4.38	5.24	6.10	6.57	7.44	15.28	23.12	35.18
5	9	19	28	37	46	56	1.5	1.14	1.24	1.33	3.5	4.38
10	5	9	14	19	23	28	32	37	42	46	1.33	2.18
15	3	6	9	12	15	19	22	25	28	31	1.2	1.33
20	2	5	7	9	12	14	16	19	21	23	46	1.10
25	2	4	6	7	9	11	13	15	17	19	37	56
30	2	3	5	6	8	9	11	12	14	15	31	47
35	1	3	4	5	6	8	9	11	12	13	26	40
40	1	3	4	5	6	7	8	9	10	12	23	35
45	1	2	3	4	5	6	7	8	9	10	22	31
50	1	2	3	4	5	6	7	8	9	10	20	28
gm. per sq. ft.	1.72	3.44	5.16	6.88	8.60	10.32	12.03	13.75	15.49	17.20	34.40	51.60
oz. per sq. ft.	0.061	0.121	0.18	0.24	0.30	0.37	0.43	0.49	0.55	0.61	1.21	1.82

SILVER

Electrochemical equivalent = 0.001118 gm. per coulomb.

Ag +

Electrochemical equivalent = 0.000339 gm. per coulomb.

ZINC

D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
38	1.16	2.33	3.5	4.68	5.85	7.02	8.19	9.36	10.53	11.70	23.40	35.10
5	8	15	23	30	38	46	53	61	69	77	154	231
10	4	8	11	15	19	23	27	30	34	38	76	114
15	3	5	8	11	13	15	18	20	23	25	51	76
20	2	4	6	8	10	11	13	15	17	19	38	57
25	2	3	5	6	8	9	11	12	14	15	31	46
30	1	3	4	5	6	8	9	10	11	12	25	38
35	1	2	3	4	5	6	7	8	9	10	22	34
40	1	2	3	4	5	6	7	8	9	10	19	29
45	1	2	3	4	5	6	7	8	9	10	17	25
50	1	2	3	4	5	6	7	8	9	10	15	23
gm. per sq. ft.	2.46	4.95	7.42	9.90	12.38	14.82	17.30	19.80	22.22	24.78	49.50	74.20
oz. per sq. ft.	0.09	0.18	0.26	0.35	0.43	0.53	0.61	0.70	0.79	0.87	1.75	2.62

Zn ++

C.D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	1.22	2.44	3.66	4.88	6.10	7.32	8.54	9.76	10.98	12.20	24.40	36.60
5	16	33	49	66	83	100	117	134	151	168	336	504
10	8	16	24	32	40	48	56	64	72	80	160	240
15	6	12	18	24	30	36	42	48	54	60	120	180
20	4	8	12	16	20	24	28	32	36	40	80	120
25	3	6	9	12	15	18	21	24	27	30	60	90
30	3	5	8	11	14	17	20	23	26	29	58	87
35	2	4	6	8	10	12	14	16	18	20	40	60
40	2	4	6	8	10	12	14	16	18	20	40	60
45	2	4	5	7	9	11	13	15	17	19	38	57
50	2	3	5	6	8	10	11	13	14	16	32	48
gm. per sq. ft.	1.87	3.74	5.61	7.48	9.35	11.22	13.09	14.96	16.83	18.70	37.40	56.10
oz. per sq. ft.	0.059	0.108	0.177	0.236	0.295	0.354	0.413	0.472	0.531	0.590	1.180	1.770

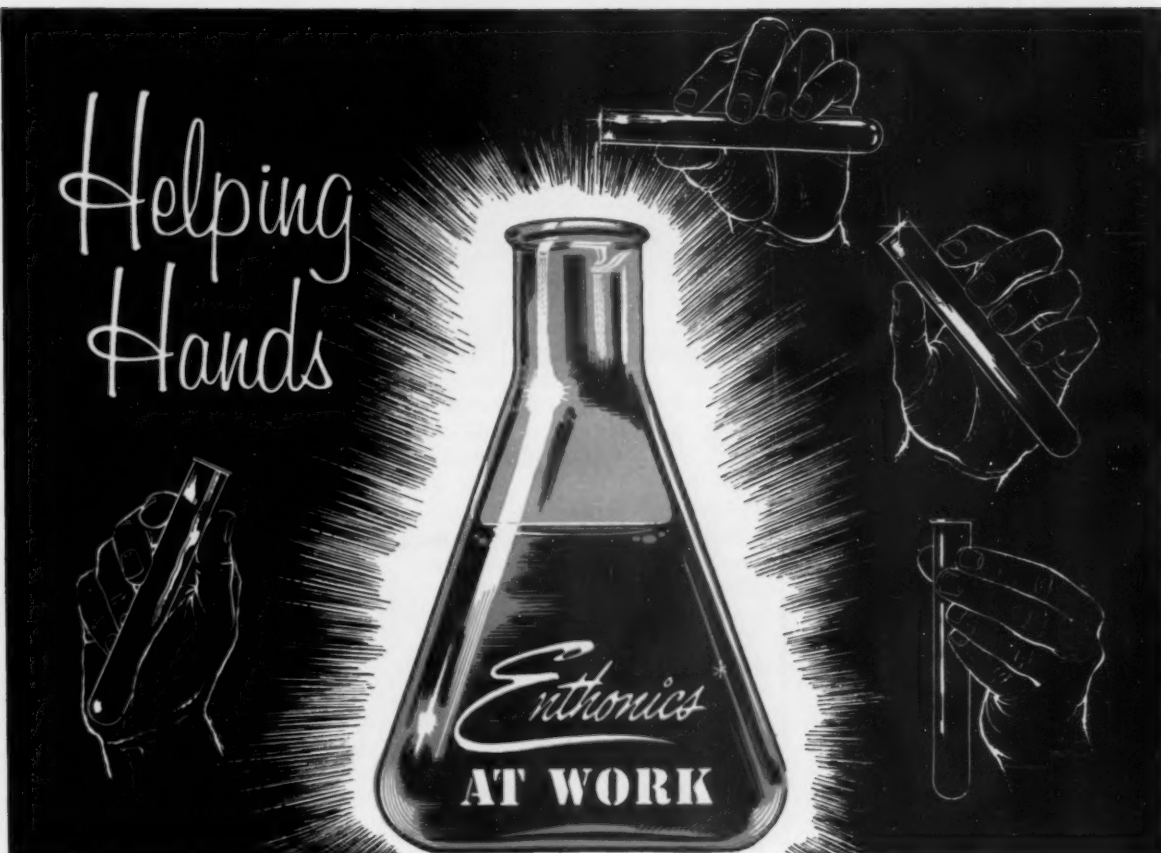
TABLE 23

NICKEL ELECTROPLATING BATHS

TYPE OF BATH	oz./gal.	gm/L.	pH ELECTROMETRIC	TEMPERATURE F	NORMAL CATHODE CURRENT DENSITY (a.s.f.)
COLD					
Nickel Sulfate	16	120	5.0-5.5	room	5-10
Ammonium Chloride	2	15	—	—	—
Boric Acid	2	15	—	—	—
ELECTROTYPE					
Nickel Sulfate	9	70	5.6-6.0	90	10-20
Ammonium Chloride	0.7	5.5	—	—	—
WATTS—High pH					
Nickel Sulfate	32	240	4.5-5.6	115-120	20-100
Nickel Chloride	6	45	5.6-6.0	150-160	—
Boric Acid	4	30	—	—	—
WATTS—Low pH					
Nickel Sulfate	44	330	1.5-4.5	115-140	25-100
Nickel Chloride	6	45	—	—	—
Boric Acid	5	38	—	—	—
CHLORIDE					
Nickel Chloride	40	300	2	140	25-100
Boric Acid	4	30	—	—	—
CHLORIDE-SULFATE					
Nickel Sulfate	26	200	1.5	115	100
Nickel Chloride	23	175	—	—	—
Boric Acid	5.3	40	—	—	—
HARD NICKEL					
Nickel Sulfate	24	180	5.6-5.9	110-140	25-50
Ammonium Chloride	3.3	25	—	—	—
Boric Acid	4.0	30	—	—	—
BRIGHT NICKEL					
Nickel Sulfate	Proprietary	—	2.3-4.5	115-140	—
Nickel Chloride	—	—	—	—	—
Boric Acid + Brightening additions	—	—	—	—	—
BARREL					
Nickel Sulfate	20	150	5.0-5.5	75-90	—
Ammonium Chloride	4	30	—	—	—
Boric Acid	4	30	—	—	—
HIGH SULFATE—for plating on zinc					
Nickel Sulfate	13	100	5.3-5.8	70-90	10-35
Ammonium Chloride	4	30	—	—	—
Anhydrous Sodium Sulfate	13	100	—	—	—
Boric Acid	2	15	—	—	—
BLACK NICKEL					
Nickel Sulfate	10	75	5.6-5.9	120-130	5-20
Nickel Ammonium Sulfate	6	45	—	—	—
Zinc Sulfate	5	37	—	—	—
Sodium Thiocyanate	2	15	—	—	—

Table courtesy The International Nickel Co., New York

Helping Hands



FROM THOUSANDS of TESTS come the solutions to your metal finishing problems.

If you are looking for creative chemistry to supply new methods for the improvement of metal finishing, look to the leader — ENTHONE. Write for the answers to these problems, identifying them by number. If your specific problem is not listed, Enthone will gladly help to find the answer.

1. HOW TO BLACKEN copper, brass, zinc, steel and other metals to meet U.S. Government specifications.
2. HOW TO STRIP NICKEL from steel without etching the steel.
3. HOW TO STRIP NICKEL from copper and brass without attacking the part.
4. HOW TO SHED WATER from metals to prevent staining or spotting during drying.
5. HOW TO TRAP FUMES from hot sulfuric acid pickles.
6. HOW TO STRIP SYNTHETIC ENAMELS from aluminum and other metals without attacking the metal.
7. HOW TO CLEAN AND REMOVE RUST AND OXIDES from steel in one operation without acids.
8. HOW TO RINSE AND DRY STEEL WITHOUT RUSTING, using cold or hot water.
9. HOW TO SHORTEN ALKALI CLEANING TIME for steel to 15 seconds.
10. HOW TO REMOVE SOLID DIRT AND OIL from metals.
11. HOW TO STRIP LEAD, TIN or soft solder from copper and brass with no etching.
12. HOW TO PLATE METALS upon aluminum.
13. HOW TO REMOVE EXCESS SILVER SOLDER chemically from silver brazed steel parts.
14. HOW TO MAKE PAINT STICK to brass and zinc.
15. HOW TO SOLVENT-CLEAN parts and assemblies with cold non-hazardous solvent.
16. HOW TO OVERCOME CHROMIC ACID CONTAMINATION in cleaners.
17. HOW TO PREVENT STAINING of chromium plate.
18. HOW TO GIVE ZINC AND CADMIUM high salt spray resistance.
19. HOW TO COLOR ALUMINUM in one operation.
20. HOW TO STRIP METAL COATINGS from zinc die castings.

* The Scientific Solution of Metal Finishing Problems.

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June 28, 1956

129

ULTRASONIC CLEANING BY THE SQUARE FOOT

Recent improvements in ultrasonic power-generating equipment, and the perfection of hermetically-sealed transducers operating at 40 kc/sec, have now made it economically feasible to apply ultrasonic cleaning to areas measured by the square foot. Up to now, cost and technical problems have largely confined the benefits of this fast and efficient technique to relatively small units.



The large, uniform radiating surface of the transducers makes them particularly suitable for the removal of buffing compounds, radioactive contamination, soldering flux, plaster, carbon smut, etc. The transducers can also be used for other processes such as quenching, plating, pickling, descaling and dyeing. The cleaning action penetrates deeply into blind holes and other areas difficult or impossible to clean by conventional methods.

The Branson LF-15 Transducers have a radiating surface 2½" x 6", with thick barium-titanate driving elements that transmit the energy through the top of the stainless-steel housing directly into the cleaning solvent. The modular design of the transducers facilitates a wide choice of flush and focused arrangements of transducers.

Generator-Transducers combinations are available with radiating areas from ¼ to 10 square feet:

SONOGEN® MODEL	TRANSDUCER CLEANING AREA
AP-25	¼ Sq. Ft.
APT-100	1
APT-400	4
P-1000	10

Cost of complete equipment, per square inch of radiating surface, ranges from \$23 down to \$14. We will be happy to send you complete information on request.

BRANSON ULTRASONIC CO.
Division of Branson Instruments Inc.
23 BROWN HOUSE ROAD
STAMFORD, CONN.

Ten Ways To Check Deposit Thickness

Microscope method—The methods for checking deposit thickness are: One of the most accurate methods of checking because actual plate thickness is seen through a microscope equipped with an eye piece calibrated for exact measurement. A section of the plated object is cut perpendicular to the deposit to get a true thickness.

After cutting, the article is then mounted in a low-melting alloy, plastic, or a similar substance, and polished and etched. The sample is then placed under the microscope and brought into focus. If the microscope has a micrometer eyepiece, the thickness of the deposit can be read directly.

Measle chord method—Depends on filing a curved surface until the base metal is exposed, then measuring the length of the file mark. If the object is flat, a precision grinding wheel is used until the base metal is reached and the length of the grind mark is measured. In either case, the thickness can be obtained by using the formula:

$$\text{Thickness} = \frac{C^2}{8R}$$

C=length of cut

R=radius of the grinding wheel or object.

The radius of the grinding wheel can be measured directly. The radius of a curved surface can be measured with a spherometer.

Micrometer method—Consists of obtaining the thickness of several pieces before plating, then plating the pieces and again checking them for thickness. An alternate method is to plate the object and obtain its thickness by micrometer, then strip the deposit and recheck the thickness.

Induction method—Originally developed for organic or nonconductive coatings, it can be used to calibrate metallic coating thicknesses. The apparatus consists of a coil of wire around a laminated steel core which is closed on all sides except one. The coil is connected to a source of current and a galvanometer that is enlarged by an amplifying system. Current flowing through the coil is measured by a sensitive galvanometer. Any change in current flow is immediately registered.

The electrical circuit is closed and the flow of current through it can be varied only by changing the magnetic flux. This is done by bringing the open side of the lamination near a metallic body such as steel. When the steel is brought near, a definite deflection occurs. If the steel is covered with zinc, cadmium, brass, or other metal, the coating insulates the steel from the laminated core which affects the deflection of the galvanometer. This deflection depends upon the thickness of deposit.

Jet method—Although not in general use now, it has been applied to copper, nickel, bronze, cadmium and zinc with good results. It uses a steady stream of solution impinging on the plated surface instead of successive drops. Coatings of commercial thicknesses require 1 to 2 min for penetration. Accuracy is about 15 pct. The coating is destroyed but the object can be replated easily.

Apparatus consists of a burette having a capacity of 100 cc. The orifice should be adjusted so 10 cc of water pass through in 30 sec. To maintain uniform flow, a reservoir bottle is connected so that the head of liquid is constant at all times.

The surface to be tested must be free of grease, oil and dirt.

TEN WAYS

The object to be tested is clamped about $\frac{1}{4}$ in. below the jet at a 45° angle. The stream of liquid and a stop watch are started simultaneously and allowed to proceed for 5 to 10 sec. The spot is then examined. This is repeated without removing the last piece until penetration below the jet is observed. The time required to accomplish this is compared to the time necessary for the same solution to penetrate the same coating 0.001 in. thick.

The solutions used depend on the coating being tested. For nickel, a solution containing ferric chloride, cupric sulfate and acetic acid is used. At 68°F , 0.0001 in. is removed in 11 sec.

	g. per liter	ox. per gal.
Ferric chloride $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$	100	13.33
Cupric sulfate $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	250	33.44
Acetic acid $\text{HC}_2\text{H}_3\text{O}_2$	250	35.41

Spot method—Used for chromium deposits too thin to be determined by the microscope or chord method. It consists of placing a drop of concentrated hydrochloric acid on the chrome deposit and timing the period of gassing. At 70°F , each second is equivalent to 0.000001 in.

Since it depends on the chromium going into solution, the metal surface must be clean and in the active state. If the metal is dirty or passive, the chromium will not react as readily and will give too high a result.

Chemical strip method—It is generally conceded to be the standard method. It is accurate but time consuming and a technique is required. The method may be modified so that it is similar to the micrometer method in that the material thickness is determined with a micrometer, then stripped. The thickness is again taken and the difference is the coating thickness.

The object can also be weighed before plating. After plating, the object is reweighed and the dif-

Stop Aluminum Corrosion!

Insure Paint Adhesion

Provide Ornamental Finish

TURCOAT 4178

(Aluminum Surface Conversion Coating)



DOES ALL THREE!... Fixes Immediately, Too

Here's a process that provides aluminum with an ornamental, paint-gripping, corrosion-resistant coating... and does it faster and better!

Turcoat 4178 works on the surface conversion principle... that is, the coating is partially derived from the metal itself. Thus, coating and metal are firmly interlocked... even in tiniest crevices. The coating is a light golden color that imparts a special beauty when used for decorative purposes.

One user reports that square footage processed has doubled since the installation of Turcoat 4178. Key to this speed is the manner in which the coating "sets" and becomes non-smearing immediately. Drying is unnecessary. Parts can be further processed without any delay in production! Moreover, the coating is uniform. There are no light, tell-tale untreated sections around welds, corners or holes.

The Turcoat 4178 Coating becomes non-smearing immediately upon withdrawal from processing. Drying is unnecessary. Parts can be handled freely while still wet without danger of smearing or streaking coating.



MEETS GOVERNMENT SPECIFICATION

Meets Government Specification MIL-C-5541.



EASY TO CONTROL

Simpler titrations... Great latitude in solution strength. Eliminates need for constant complicated control.



EASY TO USE

Apply by immersion, spray washer or hand methods. Gold color gives visual control over processing.



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Please send me detailed technical information on Turcoat 4178.

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JA

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MALLEABRASIVE was developed through exhaustive research. Its leadership has been maintained through continuing research and improvement.

- Today there is still only one genuine MALLEABRASIVE.
- MALLEABRASIVE has no exact counterpart—there is no other product exactly like it.
- MALLEABRASIVE is patented because of its own distinctive metallurgical characteristics.
- MALLEABRASIVE is produced only by manufacture under the full and complete MALLEABRASIVE process—used by Globe exclusively.

The qualities that make Malleabrasive distinctively different have made it the most widely used premium abrasive in the world today. In hundreds of plants it has made important reductions in blast-cleaning costs. Undoubtedly it can do the same in yours. At least, why not investigate its possibilities? Write us.

THE GLOBE STEEL ABRASIVE COMPANY
MANSFIELD, OHIO

Subsidiary of Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Also sold and recommended by Pangborn Corp., Hagerstown, Md.

MALLEABRASIVE®

ference is the weight of the deposit. If the density of the plate is known, the thickness can be calculated from the weight.

The best method of checking thickness is to strip off the deposit in a solution of known volume, then determine the amount of the deposit in the stripping agent by chemical means. The plated thickness can be calculated from the weight if the density is known.

Anodic Solution Method—In this method, an electronic instrument operates by anodically deplating a small area of the test specimen. A cell, which holds the test solution, is the cathode while the test piece serves as the anode.

Until the basis metal is exposed, a certain voltage characteristic of the plated metal exists across the cell. The voltage changes sharply when all plated metal is removed from the test spot. This voltage change is the end point of the test, at which time the instrument automatically turns itself off.

The time necessary to deplate the test spot is directly proportional to the thickness of the plating. Correlation of the test spot area with the current used for deplating can be read directly in terms of unit thickness by means of a counter.

Area of the test spot is controlled dimensionally by an accu-



"Doesn't leave any doubts about when coffee break is over does he?"

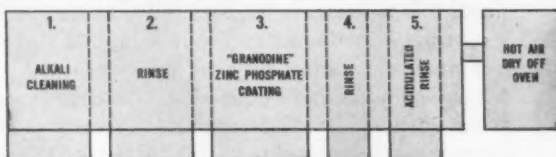
GRANODIZING PROCESS PRODUCES STEEL DRUMS FREE OF GREASE, DIRT, SCALE—AND RUST INHIBITED

Photo courtesy United States Steel Products Division, U.S. Steel Corp., Camden, N.J.



TREATMENT OF UNASSEMBLED SHELL, head and bottom drum sections is done in this power spray washer. Conveyor carries drum parts through five cleaning, rinsing and phosphate-coating stages. Drying oven removes moisture from parts prior to painting. Finish is durable and better looking.

**5-stage process uses Granodine®
to provide better paint adherence
and underfinish rust resistance**



1-YEAR EXPOSURE TO WEATHER proves the effectiveness of the phosphate coating. Untreated drum at right is rusted and pitted. Phosphate-coated drum at left has retained its finish. Coating provides a firm, durable bond for paint, retards corrosion.

In the Granodizing process, drums fabricated from steel are both freed from grease, oil and dirt and protected by a rust-inhibiting nonmetallic crystalline zinc phosphate coating over the entire inner and outer surfaces. Residues and contaminants are completely removed to assure high product purity.

Cleaning and phosphate-coating operations are done in a large high-speed power spray washer. Continuous spray phosphatizing machines such as this are used where large quantities of similar products are treated. Since Granodizing is effective only on greasefree surfaces, such machines must provide the steps

necessary to remove all impurities. This is done by passing the work through five cleaning and rinsing stages.

The process as developed is another example of the technical assistance which ACP offers its customers. Our Engineering and Service Departments not only recommend the proper equipment, but instruct plant personnel in its operation, and check samples of the finished product in our own Quality Control Laboratory.

May we help you? Write or call us for complete information about Granodizing with Granodine.

AMERICAN CHEMICAL PAINT COMPANY, Ambler 20, Pa.

DETROIT, MICHIGAN

ST. JOSEPH, MISSOURI

NILES, CALIFORNIA

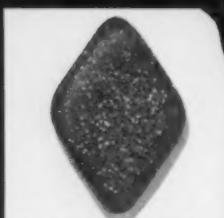
WINDSOR, ONTARIO



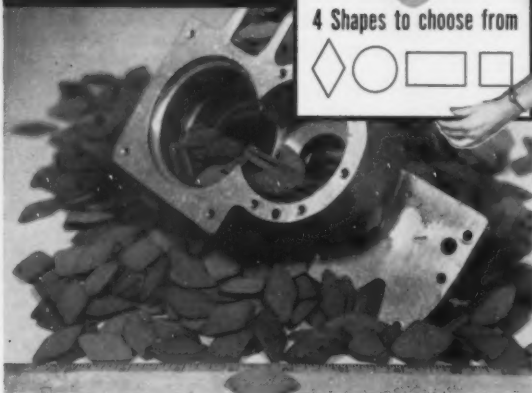
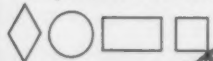
it's the **SHAPE** that counts!

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**ABRASIVE
MEDIA**
for **PRECISION
BARREL FINISHING**



4 Shapes to choose from



Outlasts other media as much as 10 to 1

Controlled grain size Aluminum Oxide bonded firmly with a specially formulated synthetic rubber to allow finishing of precision parts hitherto impossible to barrel finish. Molded and cured to a controlled hardness that assures long life and maximum cushioning yet gives desired cutting, honing or polishing action. New "Burrets" permit abrasive action in the most remote corners and recesses of delicate, precision parts. Will not chip or splinter into odd shapes, thus allowing barrel finishing of complicated precision parts without fear of loading or damage, also eliminating the slow, costly and continuous sizing necessary with other types of media. *May be used with any equipment.*

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THE SPACE-MISER . . . A complete barrel finishing shop in one unit. May be installed in a very small work area.

MEDIA and COMPOUNDS . . . Speed-D-Burrets and all other known types and sizes. A complete selection for every barrel finishing requirement.

HANDLING EQUIPMENT . . . All optional handling, media storage, separation and other equipment for complete barrel finishing.

Service is our most important product . . . it does not cost — IT PAYS!

SPEED-D-BURR CORPORATION
3613-f San Fernando Road, Glendale 4, Calif.

TEN WAYS

ately perforated rubber gasket. Test solutions are formulated to give 100 pct efficiency. They do not attack the plating unless current flows through the cell. To make certain that the solution operates at full efficiency as intended, the solution is agitated within the test cell.

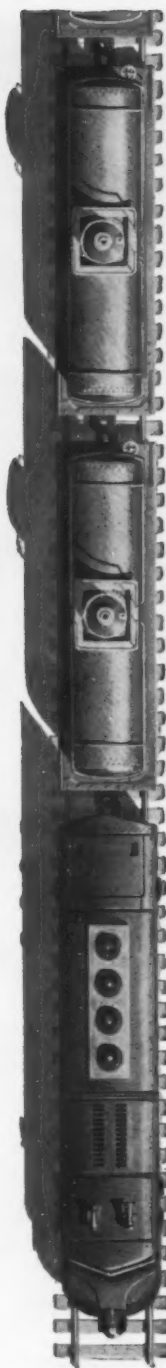
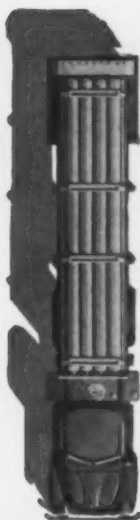
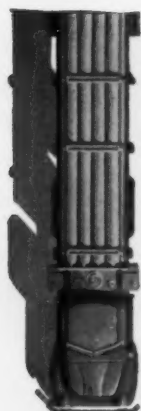
Drop test method—A standard solution is dropped on the article to be tested at the rate of 80 to 120 drops per minute until the deposit is dissolved by chemical action and the base metal is exposed. The time to accomplish this is noted in seconds, each second being equivalent to 0.00001 in. of deposit thickness. Standard solutions are:

	g. per liter	oz. per gal.
For zinc:		
Ammonium nitrate	100	13.33
NH_4NO_3		
Concentrated nitric acid		
HNO_3	75	.10
For cadmium:		
Ammonium nitrate		
NH_4NO_3	110	14.67
Concentrated hydrochloric acid		
HCl	13.7	1.83

The drop method is inexpensive to install and operate. Its accuracy is good enough for average shop plating of zinc and cadmium.

A thickness indicator developed at the National Bureau of Standards is being used in industry for checking the thickness of nickel deposits on non-magnetic base metals. The nickel, being magnetic, exerts a pull on the magnet which is directly proportional to the deposit thickness.

One method of applying the test is to suspend the magnet from a spring attached to a dial. After the magnet is placed on the nickel coating, a pull is exerted on the magnet by turning the dial. When the magnet breaks away, a direct thickness reading can be obtained if the scale is calibrated. The apparatus is quite simple to use, gives rapid readings, and is non-destructive to the coating.



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BORON TRIFLUORIDE
HYDROFLUORIC ACID
*anhydrous . . . aqueous***

Here are many more production-controlled, high-quality fluorides:

Ammonium Bifluoride	Hydrofluoric Acid
Ammonium Fluoborate	Aqueous
Antimony Trifluoride	Hydrofluosilicic Acid
Sublimed	Lead Fluoborate
Barium Fluoride	Metallic Fluoborates
Bismuth Fluoride	Potassium Bifluoride
Boron Trifluoride	Potassium Chromium
Boron Trifluoride	Fluoride
Complexes	Potassium Fluoborate
Chromium Fluoride	Potassium Fluoride
Copper Fluoborate	Potassium Titanium
Fluoboric Acid	Fluoride
Fluorine Cells	Silico Fluorides
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Anhydrous. It provides
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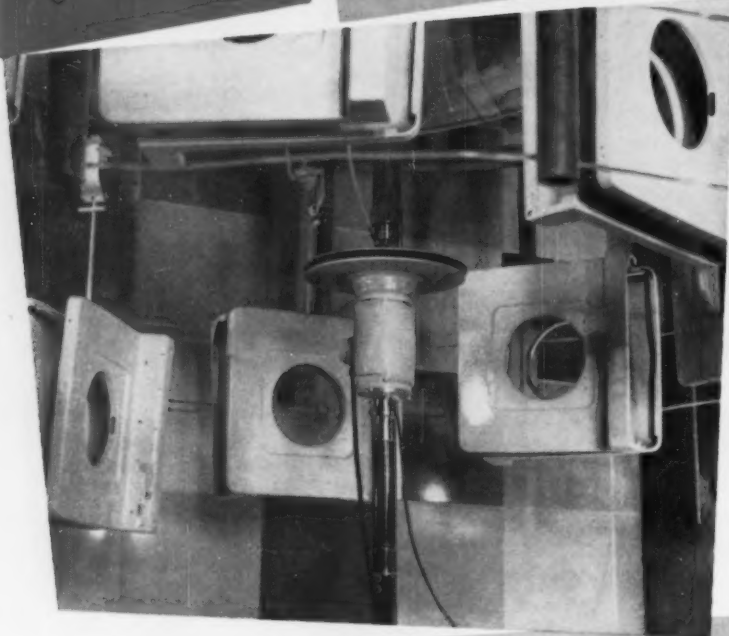


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General Electric—an extensive user of Ransburg Electro-Spray for painting with synthetic enamels—is the first to use Ransburg No. 2 Process in the application of porcelain enamel.

GE—less than a year in electrostatic production—now is processing almost a million square feet of cover coat each month in the General Electric Home Laundry finishing department at Appliance Park.

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Quality of appearance and chip resistance are greatly improved with all colors: white, yellow, pink, turquoise, blue and brown.

About 97% of the atomized enamel is deposited on the washer and dryer parts.

Because of improved uniformity in coating thickness, weight of applied enamel was substantially reduced.

Because of lower application weight, the few rejected parts can be re-processed more times before being scrapped. This reduces the ultimate scrap rate by at least 95% of that previously expected.

Efficiency, measured by the amount of good ware, averages above 90%.

*Want your
products tested?*

Ransburg has fully equipped laboratory facilities including reciprocating disks, helical conveyers, stationary disks, and the latest advancements in equipment for applying porcelain enamel with the No. 2 Electrostatic Spray Process. Manufacturers are invited to send sample products to our Indianapolis laboratories for tests and demonstrations to prove for you the advantages and benefits of electrostatic spray application of porcelain enamels.

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Indianapolis 7, Indiana

RANSBURG

Glossary of Metal Cleaning and Finishing Terms

ABRASIVE—Any substance used to rub away or wear away a surface. Applied generally to both bonded (wheels, bricks, files) and unbonded types. In blast cleaning, it means a loose material thrown against a surface with force for cleaning or carving purposes.

ACID—A chemical which gives hydrogen ions in water solution, and which neutralizes bases to form salts.

ACTIVE—Property of reacting chemically, i.e. a metallic surface upon which another metal can be electrodeposited.

ADDITION AGENT—Material added to a bath to improve quality of deposit or extend plating range.

ADHESION—Ability of a coat to adhere to the material to which it is applied.

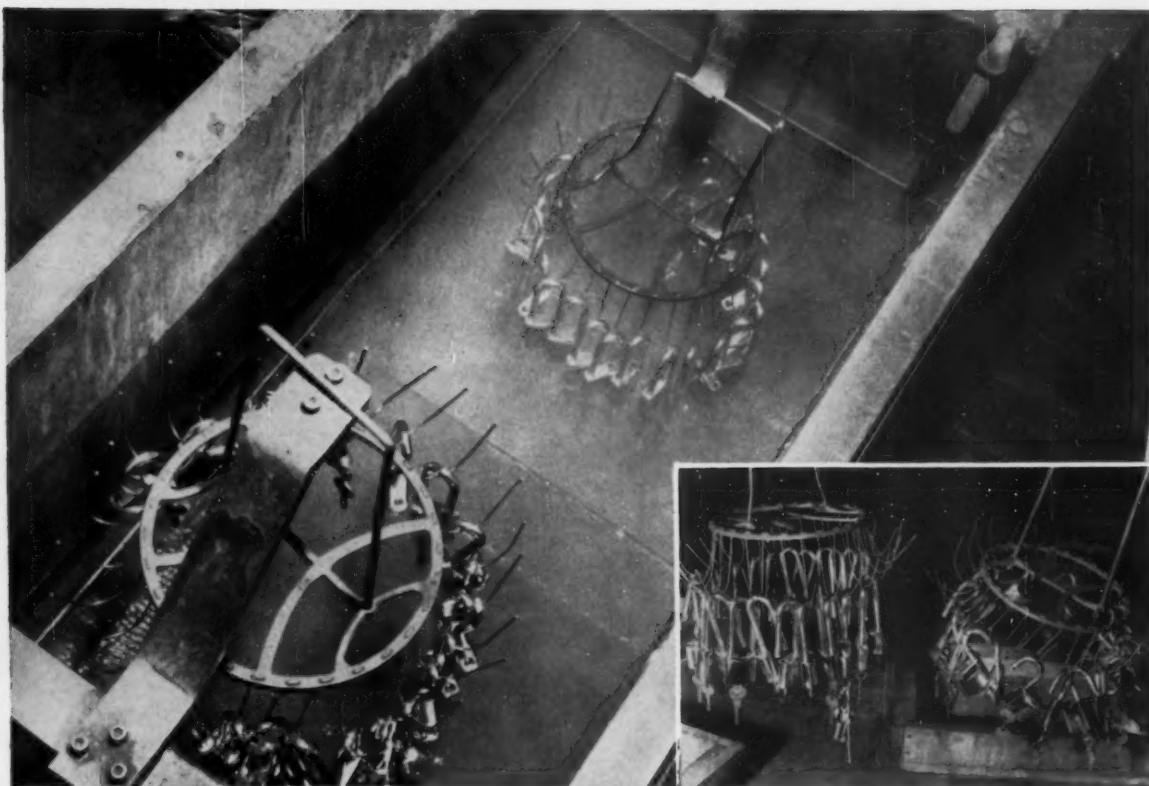
ADSORPTION—A change of concentration at an interface. In an emulsion of oil in a soap solution, soap concentrates on the surface of the oil globules (the interface between oil and water).

AIRBLAST—Treating of material surfaces by subjecting them to a bombardment of hard, granulated particles called abrasives, projected at high velocity by compressed air.

AIR HOLE—Hole or defect in casting caused by gas trapped in the metal during solidification.

AIRLESS BLAST CLEANING—Application of abrasive to object to be cleaned by a force other than compressed air, usually by centrifugal force.

ALKALI—Broadly, a material which dissolved in water will give it an alkaline reaction—that is, a pH greater than 7. Sodium and potassium hydroxides are caustic alkalis.



Brass padlock assemblies being degreased. "Triclene" D assures clean, dry, metal surfaces, ready for subsequent treatments.

Padlock assemblies prior to degreasing. Key sets are left in the locks to eliminate possibility of mixing keys.

American Hardware Reports:

"50 to 75% longer time between degreaser cleanouts ... brighter cleaning ... with TRICLENE® D"

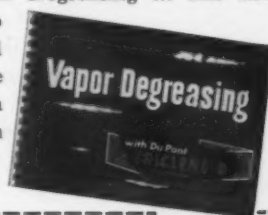
In April 1955, the P. & F. Corbin and Russell & Erwin Divisions of the American Hardware Corp., New Britain, Conn., began using "Triclene" D trichlorethylene exclusively in their six conveyORIZED and three manual degreasers. Their builders' hardware line includes locks and door fittings with highly polished surfaces of brass, bronze, copper, steel and zinc.

Since they started using "Triclene" D, they report: "...brighter cleaning...no necessity to wipe parts before lacquering." They also noted a steadier pH and solvent went 50 to 75% longer before a cleanout was needed. Moreover, "the coils are easier to clean."

Heat, light, air, acids and aluminum chloride will not

affect "Triclene" D with locked-in stabilizers. This rugged solvent safely cleans even the most delicate metal surfaces. "Triclene" D retains its original purity longer ... gives bright cleaning of any metal, distillation after distillation. Yet it costs no more than ordinary solvents!

Get all the facts on Vapor Degreasing in this new Du Pont book. Forty-two pages of data, figures and illustrations cover all the latest developments. For a copy—without obligation—mail the coupon below.



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- Packed in polyethylene-lined fiber cartons; eliminates expensive handling, space-consuming storage and bothersome \$15.00 deposits on carboys.
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Chemical
CORPORATION**

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ALMAN GAGE—Used to measure intensity of peening.

AMPHOTERIC—Having both acidic and basic properties. Zinc and aluminum hydroxides are amphoteric. With acids they form salts (as chlorides). With alkalis they form zincates and aluminates.

ANHYDROUS — Containing no water.

ANODE—Positive electrode. The electrode at which oxidation occurs.

AQUEOUS—Watery.

ARRESTOR, DUST — Equipment which separates dust from air.

BALANCED BATH—Electroplating bath where the amount of metal supplied is about equal to the amount removed.

BARREL—In blast cleaning, denotes a type of equipment into which work is placed (usually in batches) for cleaning purposes. The modern barrel is an automatic cleaning machine which tumbles the work continuously.

BASE—A substance which gives hydroxide ions in solution and which neutralizes acids forming salts.

BASE BOX—Unit of tinplate measure. It corresponds to an area equivalent to 112 sheets of tinplate, each 14 x 20 in.; or 31,360 sq in.; or 217.78 sq ft.

BASE METAL — The principal metal in an alloy.

BASIS METAL — The metal on which an electroplate is deposited.

BATH — The electroplating solution.

BAUME SCALE—Scale of specific gravities of solutions.

BLAST CARVING — Application of abrasive force to metals, stone, wood, glass, etc., to carve a preconceived design on surface.

BLAST CLEANING—Removal of sand, scale, etc., from castings and heat-treated metals by the scouring action of abrasive projected by air, water or centrifugal force.

GLOSSARY

BUFFER — A solution which resists and compensates any change of its degree of acidity or alkalinity.

CABINET — Blast cleaning machine, usually of the type where work is placed in enclosure and cleaned by operator who stands outside and manipulates the work or the abrasive stream through armholes in machine to secure results.

CAPILLARY — A tube of very small bore; any similar pore, crack or fissure of microscopic dimensions.

CASTING WASHER—Equipment designed to clean large castings by means of coarse sand suspended in water under high pressure. The sand scours the casting, while the blast forces knock down and carry away the usual large cores.

CATHODE — The negative electrode; the electrode at which reduction occurs.

CATHODE EFFICIENCY — The percentage of current required to produce the required plate at the cathode.

COLLOID — A phase subdivided and dispersed to such a degree that its surface forces become an important factor in determining its properties.

CONCENTRATION—The amount of substance (in weight, or in per cent) contained in a unit volume of solution.

CONDUCTANCE—The reciprocal of resistance; ability to allow electric current to pass.

CONDUCTIVITY — Ability of a bath to conduct current.

CONTAMINANTS—Impurities in a plating, cleaning or pickling solution.

COOLANT — A fluid vehicle for conveying away heat.

COUNTER-CURRENT — Term applied when two streams move in opposing directions.

CRYSTALLIZATION — Formation of crystals by the atoms assuming definite positions in a crystal lattice.

CURRENT DENSITY — Amount

if your product is
PAINTED
ENAMELED
LACQUERED
LITHOGRAPHED



here's how

WEIRZIN

electrolytic zinc-coated steel

**seals it against rust
and corrosion**

Decorative color finishes adhere to Weirzin Electrolytic Zinc Coated Steel as though they were part of it.

The secret is in Weirzin's ductile zinc coating, which is bonded to the steel so tightly that it remains intact even under the most severe conditions such as high heat or humidity, deep drawing, stamping or forming. Result: no underfilm rust or corrosion.

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Weirzin is available with or without chemical treatment in coils or cut lengths, in all regular widths and gauges. If you would like specific information on the many ways in which Weirzin may benefit your product, please fill in and mail coupon (right) today.



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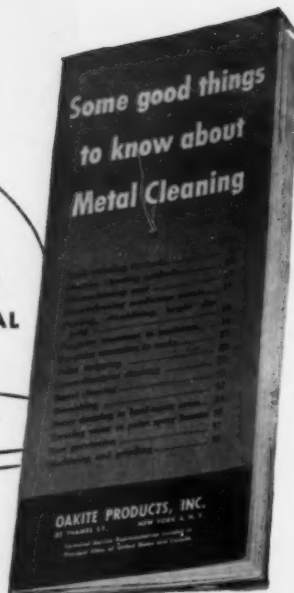
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GLOSSARY

of current per unit of area; usually expressed in amp per sq ft (a.s.f.).

CUTWIRE SHOT—Abrasive material made by cutting hard drawn steel wire into small pieces.

DECOMPOSITION POTENTIAL—The minimum potential required to start a reaction at an electrode.

DECORATIVE CARVING—Use of abrasive force to carve a design on a surface of metal, wood, glass, etc.

DEFLOCCULATE—To break up and put in fine dispersion; to put in a colloidal condition.

DESCALING—Scale removal by salt, hydrostatic pressure or high frequency.

DISPERSION—A very fine suspension, or a colloidal solution.

DRAG-IN—Impurities introduced into a bath from prior treatments.

DRAG-OUT—Solution lost from a bath on work carried out of it.

ELECTROCHEMICAL SERIES—An electromotive series.

ELECTROGALVANIZING—Deposition of zinc by electricity (as opposed to hot dip galvanizing).

ELECTROLESS NICKEL PLATING—Immersion plating of nickel.

ELECTROLYSIS—The electrochemical reactions resulting from the passage of direct current through an electrolyte.

ELECTROLYTE—A solution of a salt, and acid or a base. Solutions of these conduct electricity in varying degree. Other solutions do not.

ELECTROLYTIC CLEANING—Cleaning by, or aided by, electrolysis.

ELECTROLYTIC PICKLING—Electrochemical removal of surface oxides.

ELECTROMOTIVE FORCE (e.m.f.)—Electric potential; voltage.

ELECTROPOSITIVE—A substance which passes to the cathode during electrolysis.

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1952

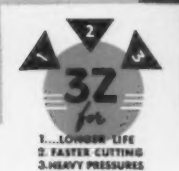
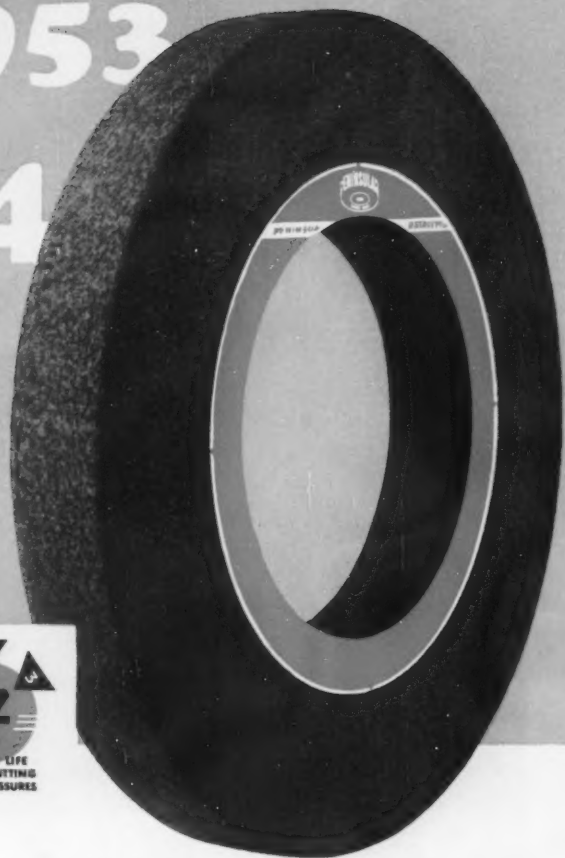
1953

1954

1955

1956

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Tru-Steel
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When it comes to blast cleaning, a foundryman can't believe claims and promises. He has to see for himself the kind of finishing job an abrasive does. His next question is: What does it cost in operation? Different jobs may require different abrasives but the result should always be the same—the best job at *lowest* cost. Malleabrasive and Tru-Steel abrasives give you that. Whichever you need, Pangborn has the right abrasive for your job. Talk to one of our sales engineers, or write PANGBORN CORP., 1500 Pangborn Blvd., Hagerstown, Maryland.

Pangborn DISTRIBUTORS FOR
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TRU-STEEL SHOT

GLOSSARY

EMULSION — A dispersion of minute drops of one liquid in another.

ETCH—Chemical removal of part of the surface of a metal, producing a rough surface.

FARADAY—The amount of electricity necessary to plate out one atomic weight of a monovalent metal (as Ag +), $\frac{1}{2}$ atomic wgt. of a divalent metal (as Cu ++), etc. $1 F = 96500$ coulombs.

FINES—Sand grain sizes substantially smaller than the usual grain size of molding sand, usually present in spent abrasive after blast cleaning because of disintegration of sand grains under abrasive force.

GAS PLATING—Plating in an enclosed and controlled atmosphere by means of heat-decomposable metal vapor compounds.

GRIT, ABRASIVE — An abrasive material consisting of crushed ferrous or synthetic material, which presents a series of fine cutting surfaces against the work to be cleaned.

HYDROLYSIS — Chemical reaction between water and a salt dissolved in it, whereby the latter partially reverts to the acid and base from which the salt was formed.

HYDROXIDE—A hydrated metallic oxide; a base; a compound which will give hydroxyl ions (OH—) in solution.

IMMERSION PLATING—Plating by chemical reduction of a metal from a solution of its salts rather than by electrolytic means.

INHIBITOR—Material which will prevent a chemical reaction from proceeding; material whose presence will prevent corrosion of metal.

INTERFACIAL TENSION — The physical force which keeps oil and water from mixing and which determines the nature of the boundary between two liquids when brought together.

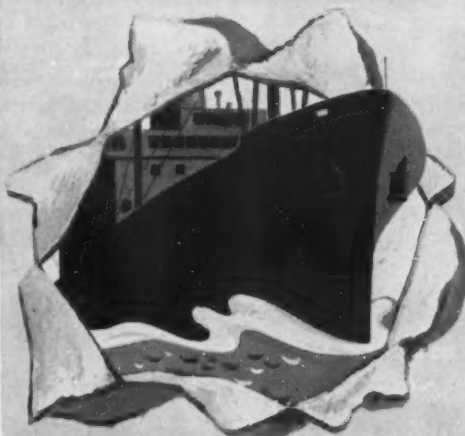
ION—An atom or molecule bearing an electric charge, in solu-

ORCHARD VPI

prevents rust

on

Borg-Warner



SHIPMENTS TO EUROPE



Borg-Warner International Corporation, Chicago, Illinois, ships transmissions to Europe for use in Mercedes-Benz, Jaguar, and other foreign cars. Wrapping and packaging for overseas shipments is done in the four simple steps illustrated. The use of Orchard VPI paper prevents rust and corrosion, and helps provide the complete protection that keeps Borg-Warner transmissions in perfect condition for two years or more.

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This four-step packaging for Borg-Warner Shipment was designed, engineered, and performed by Jerome F. Gould Corporation, export packers of Brooklyn, New York and Detroit, Michigan. VPI paper was purchased through Mid-West Paper Products Company, Detroit. Mid-West Representatives: R. M. Reutlinger & Assoc., Dayton, Ohio; Protective Packaging Co., Chicago, Illinois.

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tion. These ions are the conductors of electricity during electrolysis.

METAL REPLACEMENT — Deposition of a metal from a solution of its ions on a more anodic metal, accompanied by solution of the latter metal.

METALLIZING — Spraying a surface with metal.

MINERAL ACIDS — Inorganic

acids, commercial quality, as muriatic or sulphuric acids.

NOBLE METAL — One that deposits easily from a plating bath. At low current density, one that will deposit exclusively in competition with another metal.

OVERVOLTAGE — For the same reaction, the difference between the potential at an electrode at

which a reaction is actively taking place and another electrode at equilibrium. In plating, the minimum voltage at which reaction at an electrode just begins.

OXIDATION — Loss of electrons by a constituent of a chemical reaction.

PASSIVE — That property of a surface which inhibits chemical reaction. Electroplating is impractical on passive surfaces.

pH — Symbol used to indicate degree of acidity or alkalinity. On pH scale going from 0 to 7 we have degreasing acidity. pH 7 is neutral. From pH 7 we have increasing alkalinity up to 14.

PHASE — One of the constituents of a non-homogeneous system. In an emulsion of oil in water, we have two phases. The water (or aqueous phase) is the continuous phase. The oil is the discontinuous phase.

PICKLING — Chemical acid removal of surface oxides.

PLATING RANGE — The range of current over which a satisfactory plate can be deposited.

POLARIZATION — A reverse potential in electroplating tending to resist the flow of current.

RECOALESCENCE — The union of emulsion globules, resulting in a "breaking" or separating of the emulsion.

REDUCTION — The opposite of oxidation.

SALT — A chemical compound resulting from the neutralization of an acid with a base. "Acid salts" are incompletely neutralized acids. "Basic salts" are incompletely neutralized bases.

SAND BLAST — Method of projecting abrasive sand against a material surface to clean, cut, polish or carve. Loosely applied today to the blast cleaning process, even where metallic abrasives are used.

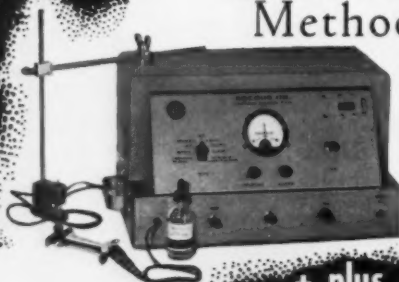
SEPARATOR, ABRASIVE — A device used in modern blast cleaning equipment to clean the spent abrasive of blasting debris and return the good abrasive to the system for re-

Check plating thickness

WITH THE

KOCOUR ELECTRONIC THICKNESS TESTER*

*Anodic Solution Method



6 Simple steps . . . to quick, accurate results

1.



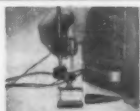
MOUNT THE CELL . . . on the spot to be tested and clip lead wire to specimen.

2.



ADD TEST SOLUTION . . . which corresponds to the type of plating and base metal tested.

3.



PLACE STIRRER IN POSITION.

4.



SET SELECTOR SWITCH to the type of plating to be tested as indicated on panel.

5.



PRESS THE TEST BUTTON to start the test . . . and upon completion the unit shuts off automatically.

6.



TAKE THE READING directly from the counter on panel (e.g., 0.00041).

TOTAL TIME . . . less than 2 minutes

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★ **Paint-Preparation Products.** Cleaning and phosphating processes: PRE-FOS,* PHOS-IT.*

★ **Paint-Department Maintenance.** Water-wash compounds, dry-wall compounds, booth-cleanout compounds.

★ **Rust and Scale Removers.**

★ **Aluminum-Specialty Products.** Etchants, de-smutting compounds, preparation for spot welding, brighteners.

★ **Rust Preventatives.** R-2, NORDALL.*

★ **Neutralizers.** For pickling and vitreous-enameling lines.

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GLOSSARY

use. Two phases of abrasive cleaning are employed: (1) a scalping wheel which removes particles larger than the abrasive size and (2) an air wash which removes small particles.

SHOT — Type of metal abrasive which consists of small spherical pellets. Cleans without the scouring effect of grit.

SOFT ABRASIVE—Type of abrasive used in blast cleaning to clear and wipe away unwanted deposits, such as caked grease, without otherwise affecting the surface.

SOLUBILITY — The amount of solute (the substance dissolved) present in a given volume of solvent or of solution.

STRIKE—A low cathode efficiency bath used to improve the bond of a subsequent plate.

SURFACE TENSION — The contractive force of a surface measured along a unit of its edge.

TARNISH—To lessen the luster of, by stain or oxidation.

TITER — The solidification point (degrees temperature) of fatty acids.

TUMBLING BARREL—A revolving barrel in which castings are cleaned by the scouring effect of abrasive as the casting-abrasive mixture is churned by the revolving action.

TURBID—Opaque with finely divided suspended matter.

VALENCE—The combining power of an element or radical as shown by the atomic weight of the element (or molecular weight of the radical).

VAPOR DEGREASING—Removal of oil or grease by solvent vapors.

WETTING AGENT — A material which will give a solution the property of low surface tension and the ability to spread and intimately wet a surface with which it comes in contact.

This glossary has been compiled from industry sources, including Magnus Chemical Co.'s "Metal-Cleaning Handbook," and "Blast Cleaning," by V. F. Stine, Pangborn Corp.

Another
Fostoria
Success
Story



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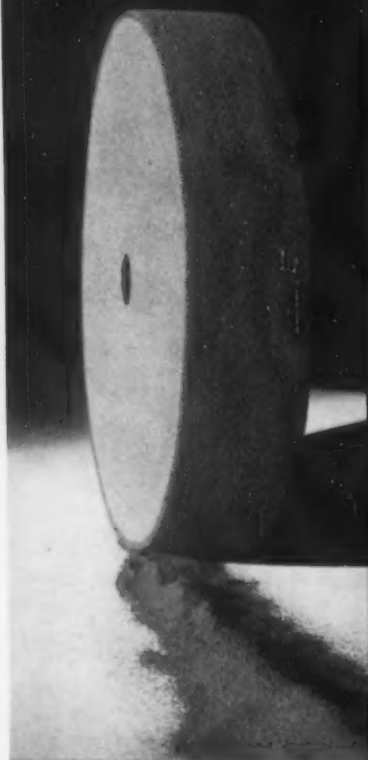


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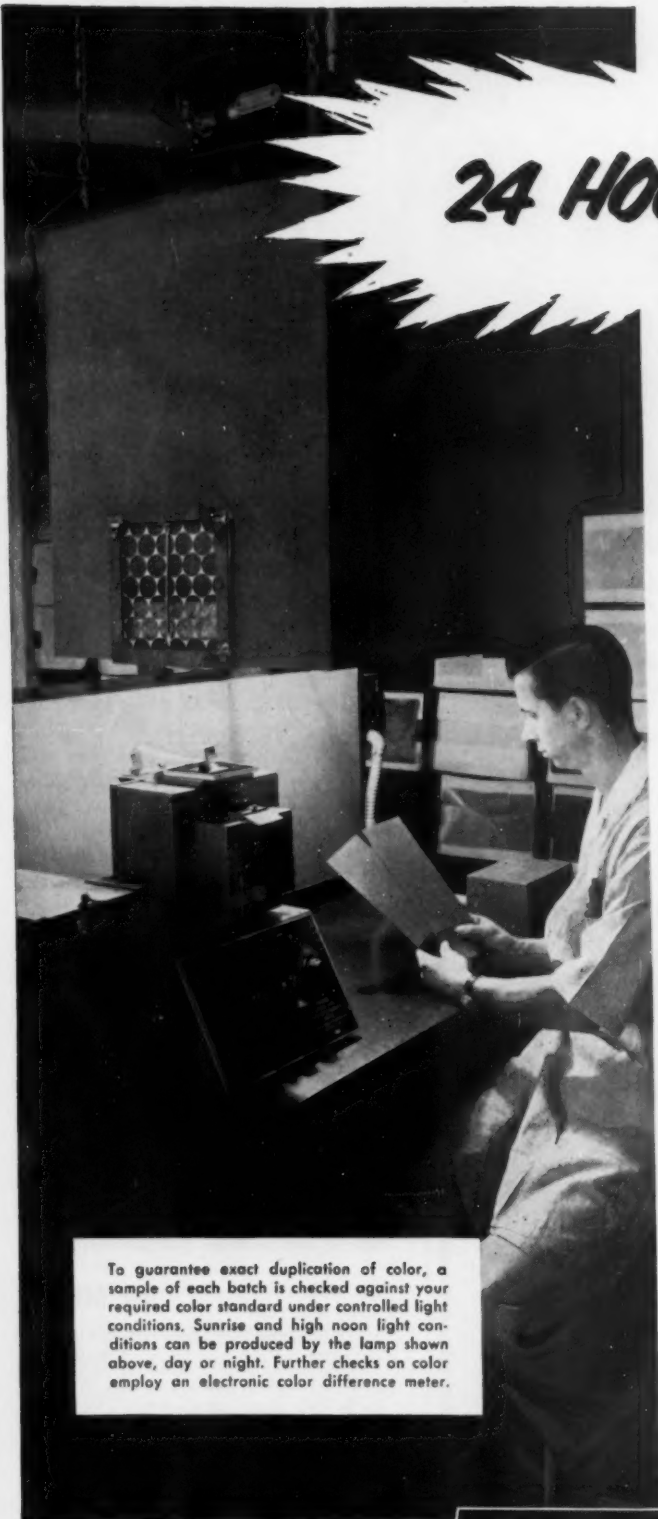
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New Technical Literature:

Catalogs and Bulletins

Limit switches

Bulletin on machine tool limit switches describes 19 contact arrangements available with seven models. Direction of lever movement and spring return, and normal and operated circuits for each position is given in handy table form. In addition brochure shows cutaway drawing of new heavy duty oil and water tight models. Comparative statistics are given of three leading machine tool limit switches. Other information is basic dimensions, principle features and customer endorsements. *R. B. Denison Mfg. Co.*

For free copy circle No. 1 on postcard, p. 153

FOR YOUR COPY

Money-saving products and services are described in the literature briefed here. For your copy just circle the number on the free postcard, page 153.

Thermocouple alloys

Thermocouple catalog contains 20 bright, colored and informative pages. It covers thermocouple alloys. Charts, drawings, tables, photographs and technical illustra-

tions give a clear picture of the company's products. Contents include: general information, Chromel-Alumel standard specifications, Chromel-Alumel non-standard material, temperature millivolt equivalents, standardization of Chromel-Alumel, Chromel-Alumel application data and thermocouple reference data. *Hoskins Mfg. Co.*

For free copy circle No. 2 on postcard, p. 153

Quarter-turn fasteners

Fasteners for quick, positive locking of removable sections are the subject of a new 12 page, two-color catalog. It describes three main types of quarter-turn fasteners and their applications for general, light, or heavy duty. It includes specifications, head styles, installation procedures, strength characteristics, and other information. Also shown are other fasteners. *Southco Div., South Chester Corp.*

For free copy circle No. 3 on postcard, p. 153

Lift trucks

Folder gives brief run down on line of lift trucks. Featuring its own power unit known as the "dyna dual," it has finger tip control, sealed gear drive, parking brake that is easily accessible, twin drive wheels. Booklet mentions noise reduction. *Lift Trucks, Inc.*

For free copy circle No. 4 on postcard, p. 153

Air filters

How an office building effected a savings of more than \$18,000 a year in maintenance costs is told in a new product bulletin that has been released by manufacturer of air filter, dust control, and heating and ventilating equipment. It tells of the maintenance problems encountered by the manager of the New England Mutual Life Insurance Co. building in downtown Boston. *American Air Filter Co., Inc.*

For free copy circle No. 5 on postcard, p. 153

Something new has been added to the "Coffee Klatch"

The Silex Company, noted manufacturers of vacuum coffee-makers, selected Hendrick Perforated Metal to fabricate this popular two-unit coffee-casserole warmer. Hendrick Perforated Metal not only adds to a product's attractiveness but it increases its salability as well. You can select from hundreds of attractive designs in commercially rolled metals and gauges to suit your most exacting requirements. Available with round, square, diamond hexagonal or slotted perforations in plain or panel effects.



Overhead conveyor

Overhead conveyor's advantages are given in a new three color folder. Described as light in weight and easy to install, literature explains conveyor's track, trolley and chair operation. Corner sprocket drives, it says, are available in two standard sizes, either 300 or 600 lb chain pull. Both have speed ranges between 0.85 and 60 fpm. Horizontal turns, vertical curves and take-ups are explained. Uses and details are included. *Alvey-Ferguson Co.*

For free copy circle No. 6 on postcard, p. 153

Machinery booklet

Company's line of varied equipment is given in a six-page booklet including coil cars, pay-off reels, automatic stitchers, press feeds, rotating feed, levelers, slitters, bridles, shears, coiling reels and special machinery. Folder tells of machines for processing and handling equipment for any ferrous or nonferrous material that starts or ends as a coil. Several photographs of company's patented (or pending) machines are included. Booklet also gives a brief rundown on firm's history and development from its founding in 1945. *Herr Equipment Corp.*

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Forged steel rolls

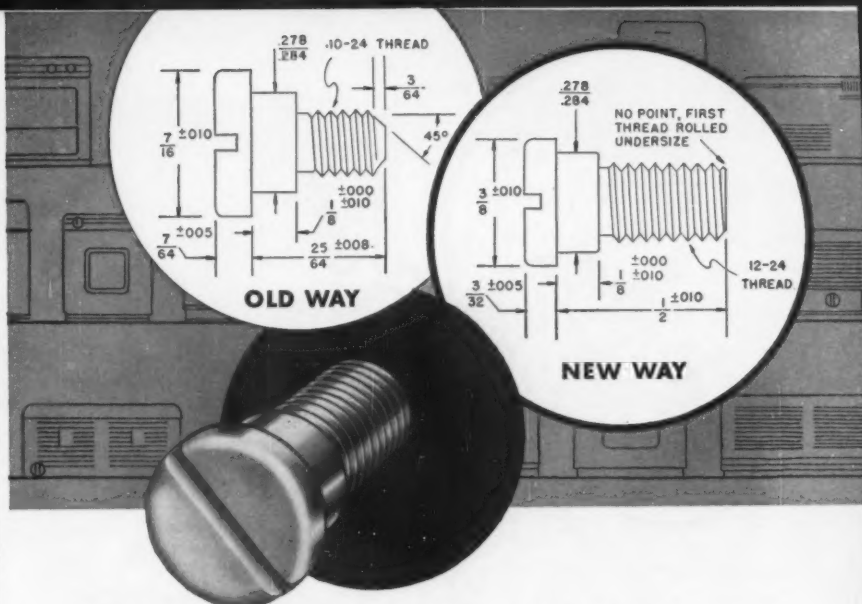
Forged alloy steel rolls are discussed from the standpoint of manufacture, types and causes of failure, in a new pamphlet, "Marathon Cold Rolls." Available types and sizes are listed for standard mills and Sendzimir, Steckel, continuous cluster and foil mills. *Marathon Specialty Steels, Inc.*

For free copy circle No. 8 on postcard, p. 153

Shell molded castings

Use of airless abrasive blast cleaning upon shell molded castings is the subject of a new piece of literature. Explaining that shell moldings need to be cleaned of sand, scale, discoloration, and grinding lines, the booklet points out three illustrated case histories where airless abrasive blasting is used for this work. Performance rates are given. *Wheelabrator Corp.*

For free copy circle No. 9 on postcard, p. 153



Townsend Design Service Reduced Cost of This Part from \$10 to \$5 per Thousand

The two parts shown above demonstrate how Townsend engineers saved an appliance manufacturer \$5.00 per thousand by redesigning a special fastener so that it could be produced by cold-forming. By redesigning this part a costly machining operation was eliminated.

The shouldered screw at left, above, an integral part of a major appliance, was originally produced by another method at a cost of about \$10.00 per thousand. Townsend engineers applied their extensive knowledge of cold-forming techniques to the problem and by slightly changing the design found that the part could be produced for about \$5.00 per thousand—a clear savings of 50% on a part used in great volume. The new part shown at right provides just as efficient a fastener as the old.

This is a typical example of how the Townsend Technical Sales Department can help you

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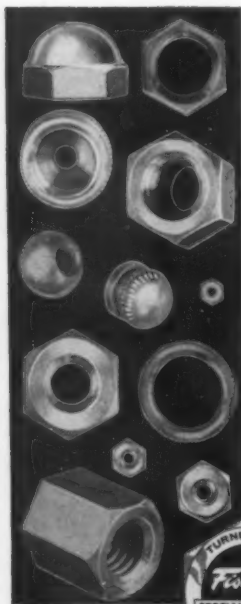
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FREE TECHNICAL LITERATURE

Materials handling

Case histories on how six prominent manufacturers in unrelated fields improved their methods of handling materials are available in a new brochure. It describes use of lightweight vulcanized fibre containers to increase efficiency, reduce costs and simplify materials handling methods. Forty-one illustrations are used. *National Vulcanized Fibre Co.*

For free copy circle No. 10 on postcard, p. 153

Ring, circle shear

Illustrated Bulletin presents ring and circle shear details including specifications, a description of the self-compensating circle arm that floats on guided ways to maintain true center automatically and the machine's versatility in cutting both straight lines and irregular outlines, as well as circles, circular holes and rings. *Niagara Machine & Tool Works.*

For free copy circle No. 11 on postcard, p. 153

Steel strapping

Ideas for utilization of steel strapping are covered in this 16 page booklet. Photographs illustrate suggested steel strapping uses as an answer to many materials handling and shipping problems. Samples of its use in varied fields are depicted. *Acme Steel Co.*

For free copy circle No. 12 on postcard, p. 153

Electric furnaces

Bulletin gives features, cross-section diagram, typical applications, and dimensions of rotary-hearth electric furnaces with maximum operating temperatures of 1800°F and 2500°F, particularly suitable for heat-treating parts that are to be fixture quenched or individually handled. *General Electric Co.*

For free copy circle No. 13 on postcard, p. 153

Nickel alloy tubing

Nickel and nickel alloy tubing is covered in a new 20 page catalog just published. It features brief but highly serviceable handbook information on nickel and nickel alloys for use by designers, production engineers and purchasing executives. *Superior Tube Co.*

For free copy circle No. 14 on postcard, p. 153

FREE TECHNICAL LITERATURE

These publications describe money-saving equipment
and services . . . they are free with no obligation . . . just
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This section starts on p. 150

Plating and anodizing

Protection of aluminum with anodizing is given in a four-page leaflet. It gives brief description of one firm's facilities for automatic polishing, anodizing and Dow treating, hard anodizing and other treatment. It gives capsule review of laboratory, anodizing department, electrostatic equipment, polishing department and units for silver and gold plating. An addressed card is included that may be checked off for information on: production baked enamel, nickel-copper-brass-silver plating, cad-zinc plating, automatic and hand polishing, aluminum plating, anodizing and aluminizing in all colors, barrel plating, hard - dense - decorative chrome plating, iridite and phosphating, and Dow treat and electroless nickel. *Atlas Plating Co.*

For free copy circle No. 15 on postcard, p. 153

Non-Flammable Solvent

A neutral, non-toxic, non-flammable solvent that cleans, degreases and rustproofs all metal surfaces in one operation is explained in a new release. Product is described as harmless and can be applied by any method now in common use to clean anything from small parts to heavy machinery. Mixed with hot or cold tap water, it is said to be superior to carbon tetrachloride, trichloroethylene, kerosene, mineral spirits and gasoline and it quickly carries off oils, soils or foreign matter, leaving a protective rustproof coating. Only a few oz. of solvent per gal of water are required to produce solvent which can be reused once foreign matter has been removed. *Harry Miller Corp.*

For free copy circle No. 16 on postcard, p. 153

Gray iron

Advantages of electric furnace iron for applications where gray iron of precisely controlled properties is required are set forth in a four-page bulletin. Folder details ten specific respects in which company's brand of electric furnace iron excels among gray irons. Principal physical properties of two grades of unalloyed iron and of two grades of the alloyed are tabulated. Folder is illustrated with photomicrographs of graphite distribution and examples of castings. *Belle City Malleable Iron Co.*

For free copy circle No. 17 on postcard, p. 153

Conversion coating

Three-page bulletin describes Turcoat 4178, surface aluminum conversion coating that stops aluminum corrosion, improves paint adhesion, and provides ornamental finish. Chief advantage claimed to be "quick fix," i.e., coating becomes non-smearing immediately on withdrawal of parts from processing. *Turco Products, Inc.*

For free copy circle No. 18 on postcard, p. 153

Griphoist Tirfor

Illustrations depicting uses and applications of one company's lift and pull unit are given in a four-page folder. Called the Griphoist Tirfor, booklet says the unit weighs only 42 lb, is hand operated by a single man, yet normally pulls or lifts 3300 lb. Description of its unique design and construction, exclusive in this country, appears. Complete specification list is given, including breakdown of weight and size, cable, propulsion, travel, operation and maintenance. *Griphoist, Inc.*

For free copy circle No. 19 on postcard, p. 153

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Barrel finishing

Reduction of production costs by 80 pct or more is the keynote of this two-color, four page bulletin. It explains one firm's precision barrel finishing as a fast, clean, economical and proven method for finishing metal parts to exact dimensions and degrees of surface finishes. The method de-burrs, micro-finishes, hones, grinds, and speed polishes steel, brass, aluminum, stainless and nickel steel castings, forgings, stampings, and machined parts. It lists satisfied users, explains precision, uniformity economy. Brief data describes experience and background on process' developer. *Miller Machine Tool & Gauge Co.*

For free copy circle No. 20 on postcard, p. 153

Spray-on galvanize

Bulletin in two colors tells of material that can be applied by brush or spray gun to galvanize any iron or steel surface of any size, anywhere (small articles can be dipped.) It is instantly effective, bulletin says, over new metal or wire brushed rust. Users report that protection lasts for years. Material consists of 95 pct zinc dust permanently suspended in a 5 pct vehicle. It comes in a single container (no mixing), does not require constant stirring when in use and has unlimited shelf life, it states. Coating is tough, flexible, nontoxic, firmly adherent and dries in 30 minutes to gray matte finish. *The Sealube Co.*

For free copy circle No. 21 on postcard, p. 153

Color identified compound

Covering specifications and application information on 14 different color-coded compounds and abrasives, a new, two-page folder has just been released. Of interest is a unique compound-use chart included. This is a quick, handy reference for determining recommended compound types for various materials and different finishing operations. Folder also includes information on color-coding features of firm's compounds and abrasives. *Esbec Barrel Finishing Corp.*

For free copy circle No. 22 on postcard, p. 153

Handling equipment

Reading matter in color supplies details, illustrations and photographs on company's industrial materials handling equipment. Conveyors of many types, sizes and capacities are covered. Drawings give complete dimensions of equipment and complete nomenclature is given. Power, drive, supports, weight, etc., are all presented in concentrated detail. Though literally packed with information, layout makes for easy reading. *The Belt Corp.*

For free copy circle No. 23 on postcard, p. 153

Floor protectors

This 12-page specification and installation manual illustrating methods for prolonging the life of industrial floors with two different floor preservers has just been published. These are heavy duty steel floor armors. One is a rigid surface armor; another, a flexible steel armored mesh. Manual has been written in a concise technical manner. It contains several pages of data tables, filler weights, specifications; illustrated installation procedures and various specialized uses of the materials. *Klemp Metal Grating Corp.*

For free copy circle No. 24 on postcard, p. 153

Bright tube finish

Folder describes a new bright finish steel tubing. It tells of clean, smooth hydraulic tubing that is cold reduced carbon steel produced by annealing in special furnaces with closely controlled atmospheric conditions. Modern, automatic control equipment, it says, maintains a rigid standard over the entire annealing and cooling cycles. They are especially recommended for hydraulic lines and diesel tubing. Tubing reduces flow resistance and offers safety from system damage. It is said to flare uniformly without cracking to provide tight, leak proof joints. Folder also emphasizes "eye appeal" saying its satin-bright appearance has more "saleability" on equipment, adding to its over-all value. Sizes and common working pressure table is listed. *Tubing Co. Div., Columbia Steel & Shafting Co.*

For free copy circle No. 25 on postcard, p. 153

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95% Efficiency at full load is standard with the new RAPID GERMANIUM RECTIFIERS. What's more, voltage is stabilized to ± 1 volt from no load to full load. And, these are just two of the many advantages of these new units.

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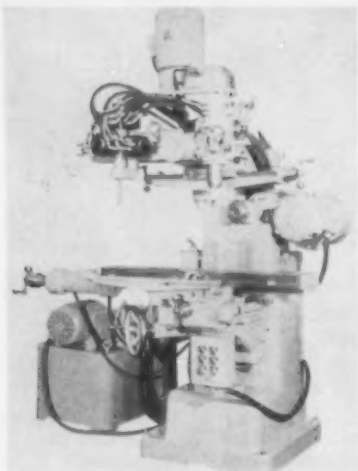
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NEW EQUIPMENT

New and improved production ideas, equipment, services and methods described here offer production economies... for more data use the free postcard on page 153 or 154.

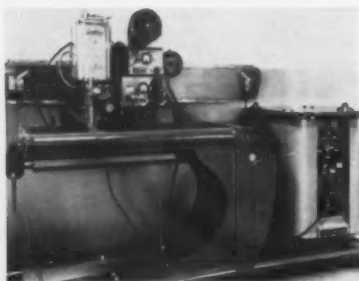


Milling machine has reversible ram turret

Now being produced is a new milling machine that will mill, jig-bore, and duplicate in three dimensions. It has a hydraulic duplicator attachment for making duplicate molds and dies, or for contour milling to templates. Duplicator sensing tracer head controls movement of the table, knee and ram slide. As operator moves the stylus over master, cutter duplicates movements. Only four ounces of stylus pressure are required to reproduce a metal, plastic or wood master. It can be effectively operated by semi-skilled labor, manu-

facturer says. It can be used for experimental, prototype or production work, as a duplicator, or as a conventional mill. The reversible ram turret has an all angle spindle head at one end and a slotting head at the other. Entire turret rotates 360° so machine can convert from milling to slotting in a few seconds. Any compound angle can be obtained. Both vertical and horizontal heads carry No. 30 NST spindle tapers to simplify tool interchangeability. *Axelson Mfg. Co., Div. of U. S. Industries, Inc.*

For more data circle No. 26 on postcard, p. 153



Longitudinal fixture welds sheets, other shapes

This new longitudinal welding fixture for fusion welding of flat sheets, cylinders, cones and other shapes has been made available to firms in the welding and engineering fields. The unit comes in a compact and versatile package described by the manufacturer as especially appealing to those con-

cerned with production shops and laboratories for welding research. It contains such features as "toe touch" foot control, multiple insert rotating back-up mandril and adjustable fingers. Maker says it's most flexible machine of its type. *Airline Welding and Engineering.*

For more data circle No. 27 on postcard, p. 153

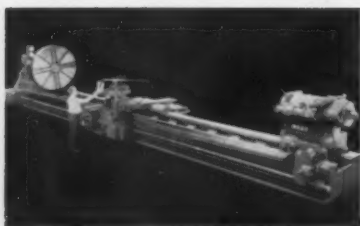


Self propelled crane has less tipping tendency

Self propelled, this 1/2 yd crane offers low center of gravity, less tipping action, greater safety factor, no hook rollers, less maintenance and easier swinging. Single engine crane is equipped with hydraulic steering and power braking, accompanied with spring

loaded parking brakes. It has two-speed, four wheel drive. Unit will turn in less than a 60 ft circle. Operator has 360° vision cab. It meets existing highway road limits according to the manufacturer. *Little Giant Crane & Shovel, Inc.*

For more data circle No. 28 on postcard, p. 153



Heavy duty lathe has faceplate drive speed

This new Niles engine lathe is a heavy-duty machine incorporating such exclusive features as: (1) Speed and load indicators on faceplate drive, (2) Load indicator on adjustable, spring loaded tailstock quill, (3) Fully enclosed leadscrew

speed and thread selector dial, (4) Hydraulic booster on the faceplate speed changer, (5) Lubrication oil-pressure protection and (6) Optional electronic feed control. *Baldwin-Lima-Hamilton Corp.*

For more data circle No. 29 on postcard, p. 153

Precision surface grinder is only 6 x 18 x 12 in.

Smooth, futuristic lines, coupled with unique construction design, give this entirely new precision surface grinder an ultra-modern appearance. Its new size, 6 x 18 x 12 in., is generally accepted as in keeping with a trend in industry toward small, yet rugged, and well-designed machines. Said to be easy to operate and maintain, it has a modern hand feed. To provide positive grinding control, new roller bearing ways, a back lash eliminator on the saddle feed and

a table cable and drum drive have been incorporated into its design. Advantages of all three features are said to have been impressively proved in rugged testing which involved over one million reversals under actual work loads. To aid operator, all controls are on the same waist-high plane. Hand wheels are recessed for comfort. The saddle is a close grain, stress relieved casting. Saddle box is five in. deep. *Abrasion Mach. Tool Co.*

For more data circle No. 20 on postcard, p. 153

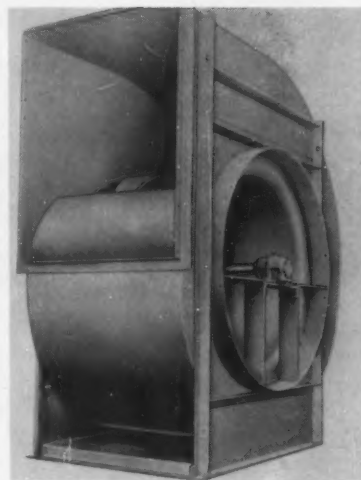


New line of airfoil centrifugal fans are unveiled

Announcement of a new centrifugal fan line with airfoil blading has been made. The series is said to make possible 92 pct peak mechanical efficiency and 88 pct static efficiency in air movement in high pressure air conditioning, industrial process ventilation and vehicular tunnel ventilation. Airfoil type blading is not only responsible for these high efficiencies but blade design lowers noise energy perceptibly as compared to conventional flat-bladed centrifugal fans, its makers say. Each fan in the series has an extremely low op-

erating cost, they say, since maximum horsepower is attained within the normal range of fan selection. Fans are designed for direct connection to conventional squirrel cage induction motors operated at standard speeds. For applications requiring regulation of air output over a wide range of operating conditions, inlet vane control is available operated manually or automatically. Sixteen models are offered with wheel diam from 27 to 108 in. *Sturdevant Div., Westinghouse Corp.*

For more data circle No. 31 on postcard, p. 153



Materials handler has no clutch pedal

Important performance improvement have been announced for this materials handler. Introduction of a relatively simple automatic power flow transmission as standard equipment is said to provide an increase in speed, power, operating ease and production capacity. It corrects power flow output automatically in direct ratio to power

requirements without shifting any gears or using a clutch pedal. A simple directional lever regulates either forward or reverse travel. Speed has been increased to 12 mph. The power ratio of 4 to 1 is said to multiply engine torque range as much as 200%. *Kwik-Mix Co., Div. of Koehring Co.*

For more data circle No. 32 on postcard, p. 153



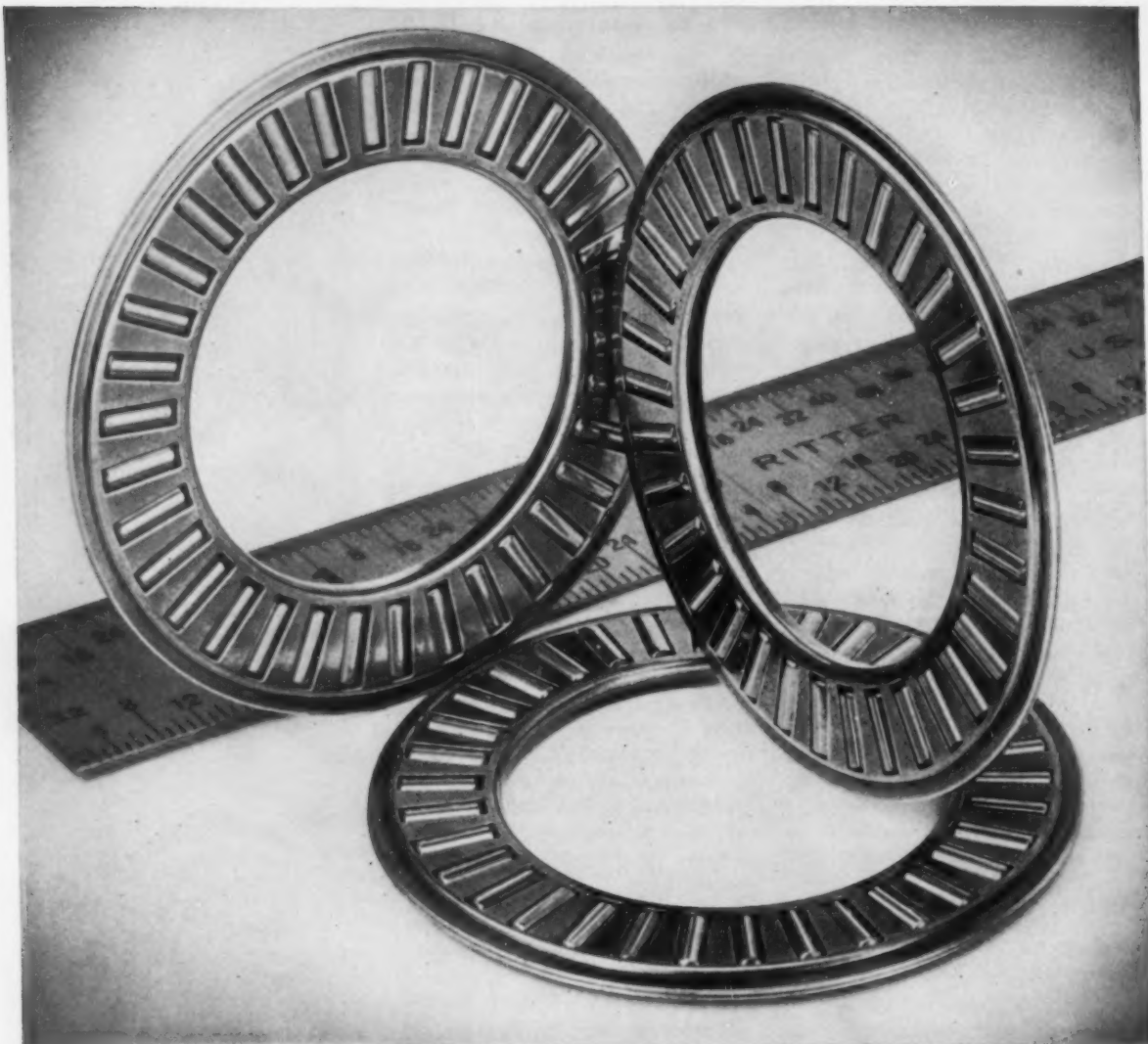
Machine separates parts from chips

Intermediate floor model chip separator separates screw machine parts from waste chips and combines high production automatic feed with the versatility required by jobbing type shops. Machine is rigidly constructed to eliminate vibration and has a newly designed automatic feeder-vibrator unit that reduces noise. A centrifugal blower

unit has 40 air settings to provide clean separation and accurate control for any size screw machine parts in diameters from 1/16 to 3/4 in., and lengths from 1/4 to 3 1/2 in. Parts and chips are fed to the separation area at a maximum rate of 1/2 cfm where they are separated. *McKenzie Engineering Co.*

For more data circle No. 33 on postcard, p. 153





Here's the **NEW** Torrington Needle **THRUST** Bearing!

Now designers have available a *needle bearing* exclusively for heavy *thrust* loads.

This compact Torrington Needle Thrust Bearing—only .0781" in cross section—is no thicker than an ordinary thrust washer. Yet it brings all the advantages of anti-friction operation at low unit cost for many thrust applications.

Two mating retainer halves, highly accurate steel stampings, are securely joined to form a self-contained unit closed on OD and ID. The bearing can

run directly on adjacent parts, hardened to act as races, or on economical hardened and ground flat races. The bearing is piloted on the retainer bore.

In any thrust application where low unit cost, high thrust capacity and compact design are primary factors, consider the Torrington Needle Thrust Bearing. Services of our Engineering Department are available to assist you with design and application.

Send for our new Bulletin, "No. 13—Torrington Needle Thrust Bearings," for full information.



Highly successful applications of the Torrington Needle Thrust Bearing have been made in automatic transmissions, governors, steering gears, bevel gears, hydraulic pumps, and torque converters.



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The Iron Age SUMMARY . . .

Steel labor is on the defensive for the first time in years . . . Industry in position to get the long-term contract it needs . . . Compromise may sweeten wage take.

Labor On Ropes . . . For the first time in years, steel company strategists have outmaneuvered steel labor. By taking the offensive from the start, industry negotiators are in position to get something they need badly—stability over a period of years.

Steel labor will growl and make threatening gestures—it may even shut down the industry in protest—but its chances of forcing another one-year contract on the industry are pretty slim.

The showdown on length of contract has been a long time coming. Steel negotiators proposed a five-year agreement and told the union, "This is it." Even with threat of a strike on their hands, steel firms held fast. It looks as though the best steel labor can hope for is a compromise—either a 3-year contract or a 5-year agreement with a 3-year reopening clause covering wage provisions.

Face-Saver . . . As a face-saving gesture toward labor, the steel companies may sweeten the pot slightly to bring the first-year cost of the "package" to around 20¢ an hr as compared with the initial offer of 17 $\frac{2}{3}$ ¢ an hr.

Meanwhile, whether there is a strike or not,

steel production will suffer. A last-minute settlement would find the industry flat on its back. If negotiations go down to the wire, production loss this week will approximate a half million tons.

And there would be another half-million-ton loss next week—maybe more—due to proximity of the July 4 holiday. Steel firms would be in no hurry to step up output over the weekend, knowing they would have to taper off again.

If there is a strike, all metalworking would be hit, but construction, oil and gas, and freight car building, especially.

Washington Worried . . . And despite top-heavy inventories of some products—particularly sheet and strip—held by other industries, there's a fly in the ointment. Imbalanced stocks—the lack of the nail for the horse shoe—can throw the best of plans out of kilter. Industry would begin slowing down in a matter of weeks.

Official Washington knows this, and is plenty worried. Behind the scenes, both sides to the contract hassle are under terrific pressure. While Administration policy is still one of "hands off," a strike could play havoc in an election year.

Steel Output, Operating Rates

Production	This Week	Last Week	Month Ago	Year Ago
(Net tons, 000 omitted)	2,339	2,290	2,375	1,770
Ingot Index (1947-1949=100)	145.4	142.3	147.9	111.5
Operating Rates				
Chicago	95.0	98.0*	99.5	70.0
Pittsburgh	98.0	95.0*	98.0	71.0
Philadelphia	107.0	103.0	106.0	70.0
Valley	96.0	92.0*	99.0	70.0
West	103.0	102.0	102.0	97.5
Detroit	100.0	98.0	97.0	67.0
Buffalo	105.0	105.0	105.0	72.0
Cleveland	103.0	96.0*	103.0	71.0
Birmingham	23.5	23.5	23.5	72.0
S. Ohio River	90.0	84.0*	90.0	70.0
Wheeling	95.0	103.0	104.0	70.0
St. Louis	95.0	97.0	99.0	69.0
Northeast	85.0	85.0	93.0	75.0
Aggregate	95.0	93.0*	96.5	73.0

*Revised

Prices At A Glance

(cents per lb unless otherwise noted)

	This Week	Week Ago	Month Ago	Year Ago
Composite price				
Finished Steel, base	5.179	5.179	5.179	4.797
Pig Iron (Gross Ton)	\$60.29	\$60.29	\$60.29	\$56.59
Scrap, No. 1 hvy (gross ton)	\$44.83	\$44.83	\$47.50	\$36.50
Nonferrous				
Aluminum ingot	25.90	25.90	25.90	23.20
Copper, electrolytic	46.00	46.00	46.00	36.00
Lead, St. Louis	15.80	15.80	15.80	14.80
Magnesium	34.50	34.50	34.50	29.25
Nickel, electrolytic	64.50	64.50	64.50	67.67
Tin, Straits, N. Y.	95.00	94.625	96.25	95.00
Zinc, E. St. Louis	13.50	13.50	13.50	12.50

Structurals Get Tighter

Market will be pinched further when federal road program gets underway . . . High-priced imports not expected to ease domestic situation . . . Sheet and strip improved.

♦ IT LOOKS AS though plate and structurals will continue scarce for many months to come. Latest tightening influence in the overall market picture—although the real impact will come in the future—is the federal government's proposed \$100-billion, long-range road building program.

Tons of steel will be needed for every mile of road built—much of it in structurals and plate. Wire mesh, reinforcing bar, and light structural shapes also will feel the pressure.

In the current market, reports are that some structural items are being shipped in from Europe. A Pittsburgh warehouse has received eight carloads of wide-flanged beams from Germany and Luxembourg. Foreign-made plate is appearing in the Chicago market, also.

But the price tags on these items are higher than domestic market prices and some warehousemen think relief to the steel-starved construction industry from this quarter will be practically nil.

Shipments of plate to tank and carbuilders in many cases are six to eight weeks in arrears. Relief from strip mills, which several weeks ago converted to rolling light plate, has not materialized. Plates under ½-in. are as tight as ever and larger sizes are, in most cases, gone for the year.

At the other end of the demand curve, ailing sheet and strip mills are showing signs of life as summer auto sales pick up. July bookings have been good and some mills are working on August. But much of this paper demand is attributed to the possibility of a strike coming off in the steel industry.

SHEETS AND STRIP . . . One Pittsburgh producer reports a solid order book on cold-rolled sheet for July. Others are offering three-week delivery, indicating that these mills have coils standing around. Customers are saying nothing about their intentions, but if orders now on the books for July and August stand up, Pittsburgh mills will be in fairly good shape. Chicago mills are current and running at full tilt through this month. Bookings through July and part of August are good, but are not expected to hold up if the steel labor negotiations end amicably. Rising auto sales have given a psychological boost to many users. The overall tone of the Detroit market is soft. Few orders are trickling in for 1957 model cars. The story is the same in Cleveland, where auto producers are holding off for the last possible moment before placing orders.

BARS . . . Large size carbon bars are still tight in Pittsburgh, but smaller sizes are plentiful. Jones and Laughlin announced a May 24 revision of chemical extras on cold-finished carbon bars and shafting. In Chicago, bars are available for at least late July delivery in most sizes and on shorter notice for lighter, cold-finished stock. Hot-rolled producers still are on 60-day cycles. Bookings run through August. Very little activity is reported in Detroit, where customers can get practically any kind and size they want. A shortage

in carbon bars at Philadelphia exists, especially in larger mill sizes. Other grades are somewhat more plentiful. West Coast mills are booked solidly through the third quarter.

PLATE AND STRUCTURALS . . . In Pittsburgh, demand continues heavy. One producer is four weeks behind on delivery of heavy plate. A warehouseman who received eight carloads of wide-flanged beams from Germany and Luxembourg says there has been no real sharpening of competition in European markets. Producers there use flexible price schedules, and right now are charging more than U. S. shippers. Tank and carbuilders in Chicago are especially pinched by the shortage of plate. Light plate being turned out by some strip mills hasn't had noticeable effect. Some foreign plate is appearing in local warehouses. High demand in Detroit is the only bright spot in that market. Mills expect the demand to remain tight for a year or more. Philadelphia area fabricators continue their high-level consumption of these items. West Coast supply is getting tighter as industrial, commercial and highway construction sets the pace.

WAREHOUSES . . . Reports from Chicago distributors run hot and cold. Some complain sales are off, others say this month has been as good as any in 1956. Inventory-building is common, even in cold rolled sheet. Customers are reported building inventory as a hedge against a steel price increase. It could account for some good-size cold-rolled and hot-rolled sheet orders that keep cropping up. Some cold-rolled sheet offered by the Detroit market has been bought up by the Chicago warehouses. On the West Coast, plate and wide-flanged beams are still the most critical items.

STAINLESS . . . U. S. Steel has officially listed Vandergrift, Pa., as a producing point for stainless sheets and plate. The Vandergrift mill turns out a wider range of sheet than the Wood Works, McKeesport, which it supplanted.

PIPE AND TUBING . . . Casing and tubing for oil country use vies with structurals and plate as the scarcest items in all areas. In Chicago butt-weld products, being turned out at a high level, are on six weeks' delivery. Demand for these items and mechanical specialties is strong in Pittsburgh. Carryovers are expected to go into the fourth quarter.

Purchasing Agent's Checklist

SPECIAL REPORT: Steel heads toward labor stability p. 51

HIGHWAYS: What \$100 billion program means p. 54

PAPER: Metalworking uses more in packaging p. 56

Comparison of Prices

(Effective June 26, 1956)

Steel prices on this page are the average of various f.o.b. quotations of major producing areas: Pittsburgh, Chicago, Gary, Cleveland, Youngstown.

Price advances over previous week are printed in Heavy Type; declines appear in *Italics*.

	June 26 1956	June 19 1956	May 29 1956	June 28 1955
Flat-Rolled Steel: (per pound)				
Hot-rolled sheets	4.325¢	4.325¢	4.325¢	4.05¢
Cold-rolled sheets	5.325	5.325	5.325	4.95
Galvanized sheets (10 ga.)	5.85	5.85	5.85	5.45
Cold-rolled strip	4.325	4.325	4.325	4.05
Plate	6.25	6.25	6.25	5.79
Plates, wrought iron	4.52	4.52	4.52	4.225
Stainless C-R strip (No. 302)	10.40	10.40	10.40	9.80
	44.50	44.50	44.50	41.50
Tin and Terneplate: (per base box)				
Tinplate (1.50 lb.) cokes	\$9.85	\$9.85	\$9.85	\$9.05
Tinplates, electro (0.50 lb.)	8.65	8.65	8.65	7.75
Special coated mfg. terms	9.10	9.10	9.10	7.85
Bars and Shapes: (per pound)				
Merchant bars	4.65¢	4.65¢	4.65¢	4.30¢
Cold finished bars	5.90	5.90	5.90	5.40
Alloy bars	5.65	5.65	5.65	5.075
Structural shapes	4.60	4.60	4.60	4.25
Stainless bars (No. 302)	38.25	38.25	38.25	35.50
Wrought iron bars	11.50	11.50	11.50	10.40
Wire: (per pound)				
Bright wire	6.60¢	6.60¢	6.60¢	5.75¢
Rails: (per 100 lb.)				
Heavy rails	\$4.725	\$4.725	\$4.725	\$4.45
Light rails	5.65	5.65	5.65	5.35
Semifinish Steel: (per net ton)				
Rerolling billets	\$68.50	\$68.50	\$68.50	\$64.00
Slabs, rerolling	68.50	68.50	68.50	64.00
Forging billets	84.50	84.50	84.50	78.00
Alloy blooms, billets, slabs	96.00	96.00	96.00	86.00
Wire Rod and Skelp: (per pound)				
Wire rods	5.025¢	5.025¢	5.025¢	4.675¢
Skelp	4.225	4.225	4.225	3.90
Finished Steel Composite: (per pound)				
Base price	5.179¢	5.179¢	5.179¢	4.797¢

Finished Steel Composite

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.

Pig Iron Composite

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Steel Scrap Composite

Average of No. 1 heavy melting steel scrap delivered to consumers at Pittsburgh, Philadelphia and Chicago.

	June 26 1956	June 19 1956	May 29 1956	June 28 1955
Pig Iron: (per gross ton)				
Foundry del'd Phila.	\$65.26	\$65.26	\$65.26	\$61.19
Foundry Valley	60.50	60.50	60.50	56.50
Foundry, Southern Cin'ti	62.98	62.98	62.98	60.43
Foundry, Birmingham	58.00	58.00	58.00	52.88
Foundry, Chicago	60.50	60.50	60.50	56.50
Basic del'd Philadelphia	64.48	64.48	64.48	60.27
Basic, Valley furnace	60.00	60.00	60.00	56.00
Malleable, Chicago	60.50	60.50	60.50	56.50
Malleable, Valley	60.50	60.50	60.50	56.50
Ferromanganese, cents per lb.	9.50¢	9.50¢	9.50¢	9.50¢
\$74.76 pct Mn base.				
Pig Iron Composite: (per gross ton)				
Pig iron	\$60.29	\$60.29	\$60.29	\$56.59
Scrap: (per gross ton)				
No. 1 steel, Pittsburgh	\$44.50	\$44.50	\$45.50	\$36.50
No. 1 steel, Phila. area	46.50	46.50	49.50	38.50
No. 1 steel, Chicago	43.50	43.50	48.50	34.50
No. 1 bundles, Detroit	37.50	37.50	41.50	27.00
Low phos., Youngstown	46.50	48.50	51.50	38.50
No. 1 mach'y cast, Pittsburgh	54.50	54.50	56.50	43.50
No. 1 mach'y cast, Philadelfa.	54.50	54.50	54.50	44.50
No. 1 mach'y cast, Chicago	47.50	48.50	51.50	47.00
Steel Scrap Composite: (per gross ton)				
No. 1 heavy melting scrap	\$44.83	\$44.83	\$47.50	\$36.50
Coke, Connellsville: (per net ton at oven)				
Furnace coke, prompt	\$14.50	\$14.50	\$14.50	\$13.25
Foundry coke, prompt	17.50	17.50	17.50	16.25
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electrolytic, Conn.	\$46.00	\$46.00	\$46.00	\$36.00
Copper, Lake, Conn.	46.00	46.00	46.00	36.00
Tin, Straits, New York	95.00¢	94.025	96.25	95.00
Zinc, East St. Louis	18.00	18.00	18.00	12.50
Lead, St. Louis	15.25	15.25	15.25	14.80
Aluminum, virgin ingot	25.90	25.90	25.90	23.20
Nickel, electrolytic	64.50	64.50	64.50	67.67
Magnesium, ingot	34.50	34.50	34.50	29.25
Antimony, Laredo, Tex.	33.00	33.00	33.00	28.50

† Tentative. ‡ Average. * Revised.

PIG IRON

Dollars per gross ton, f.o.b., subject to switching charges.

STAINLESS STEEL

Base price cents per lb. f.o.b. mill.

← To identify producers, see Key on p. 172 →

Producing Point	Basic	Fdry.	Mall.	Basic	Low Phos.
Bethlehem B3	62.00	62.50	63.00	63.50	
Birdsboro, Pa. B6	62.00	62.50	63.00	63.50	
Birmingham R3	54.50	55.00*			
Birmingham W9	54.50	55.00*	58.00		
Birmingham U4	54.50	55.00*	58.00		
Buffalo R3	60.00	60.50	61.00	61.50	
Buffalo H1	60.00	60.50	61.00		
Buffalo W6	60.00	60.50	61.00	61.50	
Chester C17	62.00	62.50	63.00		
Chicago I4	60.00	60.50	61.00	61.00	
Cleveland A5	60.00	60.50	61.00	61.00	65.00†
Cleveland R3	60.00	60.50	61.00	61.00	
Duluth I4	60.00	60.50	61.00	61.00	
Erie I4	60.00	60.50	61.00	61.00	65.00
Everett M6		62.50	63.00		
Fontana K1	67.50	68.00			
Geneva, Utah C7	60.00	60.50			
Granite City G2	61.90	62.40	62.90		
Hubbard Y1			60.50		
Lane Star E3		55.00			
Midland C11	60.00				
Minnesota C6	62.00	62.50	63.00		
Monessen P6	60.00				
Norville Is. P4	60.00	60.50	61.00	61.00	65.00†
N. Tonawanda T1	60.00	60.50	61.00	61.50	
Pittsburgh U1	60.00	60.50	61.00	61.00	
Sharpsville S3	60.00	60.50	61.00	61.00	
Sa. Chicago R3	60.00	62.50	63.00		
Steelton B3	62.00	62.50	63.00	63.50	
Swedeland A2	62.00	62.50	63.00	63.50	
Teledo I4	60.00	60.50	61.00	61.00	
Troy, N. Y. R3	62.00	62.50	63.00	63.50	66.00
Youngstown Y1			60.50	61.00	

DIFFERENTIALS: Add, 50¢ per ton for each 0.25 pct silicon or portion thereof over base (1.75 to 2.25 pct except low phos., 1.75 to 2.00 pct) 50¢ per ton for each 0.50 pct manganese or portion thereof over 1 pct, \$2 per ton for 0.5 to 0.75 pct nickel, \$1 for each additional, 0.25 pct nickel * Add \$1.00 for 0.31-0.69 pct phos. † Intermediate low phos. Silvery Iron: Buffalo, H1, \$70.25; Jackson, J1, G1, \$69.00. Add \$1.25 per ton for each 0.50 pct silicon over base (6.01 to 6.50 pct) up to 17 pct. Add 75¢ for each 0.50 pct manganese over 1.0 pct. Bessemer ferro-silicon prices are \$1 over comparable silvery iron.

Product	201	202	301	302	303	304	316	321	348	410	416	436
Ingot, reroll.	18.50	19.75	19.25	20.50	—	21.75	33.00	26.50	35.25	15.00	—	15.25
Slabs, billets, reroll.	23.00	25.50	23.75	26.25	26.75	27.50	41.75	33.50	44.50	19.50	—	19.75
Forg. dcs., die blks., rgs.	—	—	—	—	—	—	—	—	—	—	—	—
Billets, forging	—	31.00	31.75	32.90	34.75	33.75	52.75	39.75	52.50	25.50	26.00	26.00
Bars, struct.	—	36.75	38.00	39.25	41.00	40.25	62.75	47.25	62.00	30.50	31.00	31.00
Plates	—	38.75	40.00	40.25	42.75	42.00	64.00	51.25	66.75	31.75	33.00	32.25
Sheets	42.25	42.50	44.25	44.50	52.25	47.25	70.25	56.25	75.50	36.25	—	36.75
Strip, hot-rolled	31.00	33.50	32.00	34.50	—	37.25	59.75	45.75	61.25	28.00	—	28.75
Strip, cold-rolled	39.00	42.50	41.00	44.50	—	47.25	70.25	56.25	75.50	36.25	—	36.75
Wire CF, HR; Rod HR	—	—	36.00	36.25	39.00	38.25	59.75	45.00	59.00	29.00	29.50	29.50

STAINLESS STEEL PRODUCING POINTS:

Sheets: Midland, Pa., C11; Brackenridge, Pa., A3; Butler, Pa., A7; Vandergrift, Pa., U1; Washington, Pa., W2 (2.25¢ lower on Type 430); J2; Baltimore, Md.; Middletown, O., A7; Massillon, O., R3; Gary, Ind.; Bridgeville, Pa., U2; New Castle, Ind., I2; Ft. Wayne, J4; Philadelphia, D5.

Strip: Midland, Pa., C11; Waukegan, Cleveland, A5; Carnegie, Pa., S9; McKeesport, Pa., F1; Reading, Pa., C2; Washington, Pa., W2; W. Leeburg, Pa., A3; Bridgeville, Pa., U2; Detroit, M2; Canton-Massillon, O., R3; Harrison, N. J., D3; Youngstown, C2; Sharon, Pa., S1; Butler, Pa., A7; Wallingford, Conn., U3 (25¢ per lb higher); W1 (25¢ per lb higher); New Bedford, Mass., R6; Gary, Ind.

Bar: Baltimore, A7; S. Duquesne, Pa., U1; Munhall, Pa., U1; Reading, Pa., C2; Titusville, Pa., U2; Washington, Pa., J2; McKeesport, Pa., U1; F1; Bridgeville, Pa., U2; Dunkirk, N. Y., A5; Massillon, O., R3; S. Chicago, Ill.; Syracuse, N. Y., C11; Watervliet, N. Y., A3; Waukegan, A5; Canton, O., T3; Ft. Wayne, J4; Philadelphia, D5; Detroit, R3; Gary, Ind.

Wire: Waukegan, A5; Massillon, O., R3; McKeesport, Pa., F1; Ft. Wayne, J4; Harrison, N. J., D3; Baltimore, A7; Dunkirk, A3; Monessen, P1; Syracuse, C11; Bridgeville, U2.

Structurals: Baltimore, A7; Massillon, O., R3; Chicago, Ill., J4; Watervliet, N. Y., A3; Syracuse, C11; S. Chicago, Ill.

Plates: Brackenridge, Pa., A3; Chicago, Ill., U1; Munhall, Pa., U1; Midland, Pa., C11; New Castle, Ind., I2; Middletown, A7; Washington, Pa., J2; Cleveland, Massillon, R3; Coatesville, Pa., C15; Philadelphia, D5; Vandergrift, Pa., U1; Gary, Ind.

Forged discs, die blocks, rings: Pittsburgh, C11; Syracuse, C11; Ferndale, Mich., A3; Washington, Pa., J2.

Forgings billets: Midland, Pa., C11; Baltimore, A7; Washington, Pa., J2; McKeesport, F1; Massillon, Canton, O., R3; Watervliet, A3; Pittsburgh, Chicago, Ill.; Syracuse, C11; Detroit, R3; Munhall, Pa., S. Chicago, Ill.

No Panic in Scrap Market

Scattered hold-up orders fail to send market running for cover . . . Low inventories and bare dealer yards keep market firm in most areas . . . Drive on to improve No. 2 bundle quality.

◆ **THE MARKET** remained relatively firm as the zero hour on steel labor talks approached. Prices in most markets remained firm, although there was no uniformity of mill buying policies in the last days before strike deadline.

Some hold orders were placed on scrap shipments in scattered areas, while many mills continued to take in scrap in heavy tonnages. Inventories are not high generally and there is little scrap in dealer yards. In spite of strike uncertainty, demand for scrap at current prices is strong in most markets.

As a result of the underlying demand for scrap, **THE IRON AGE** composite price is unchanged, remaining at \$44.83.

Plans are being made by some mills to lay down industrial scrap if a strike materializes. Some brokers were paying mill price and better to get delivery by the end of the month of primary grades.

Only significant price declines occurred in Cleveland and the Valley where hold-up orders sent the price of No. 1 grades down \$2.

The Institute of Scrap Iron & Steel is taking steps to promote consumer acceptance of No. 2 bundles through an educational campaign to improve and maintain bundle quality. No. 2 bundles constitute the principal tonnage produced in dealer yards.

"Because of restrictive ordinances governing the burning of automobiles in many parts of the country, our members are having more difficulty with the scrap that comes across their scales," says E. C. Barringer, executive vice president of the Institute. "This program is designed to stop deleterious material at the source before it comes to dealer yards."

Pittsburgh . . . Some brokers here are paying the mill price and better to get delivery by the end of the month on No. 1 heavy melting. This has speeded shipments but not enough to clear up orders. Uncertainty regarding a strike has kept brokers from entering into a large scale buying push. Also, there is a shortage of good scrap at any price. At press time, most mills were still accepting scrap.

Chicago . . . A scattering of hold orders began to appear but mills in the area are continuing to take in scrap in heavy tonnages and there are indications that industrial scrap would be accepted for storage during a strike period. At least three mills have thus far been affected by hold orders and an announcement is expected from a fourth during the week. Shippers continue to move in as much scrap as they are able, under the restrictions. The market has shown little or no weakening and there is some evidence of an attempt to build yard-stocks at going prices in the expectancy of price advances following a strike, should one occur.

Philadelphia . . . Shipments are at a virtual standstill, with only one major mill in the area still accepting scrap deliveries. There have been no new sales reported. Price remains unchanged, but will definitely move depending on whether or not there is a work stoppage. There is little buildup of scrap in dealers' yards because of the scurry to meet cut off dates. And little is expected in near future because production of scrap normally drops during July.

New York . . . This market is at a virtual standstill as far as domestic business is concerned. Everyone is waiting the outcome of steel labor negotiations. Light but steady buying for export is keeping prices at going rates.

Detroit . . . Scrap men in the area are not very pessimistic regarding the market outlook. This despite the uncertainty surrounding the steel labor negotiations. They reason that even if there is a strike, Canadian mills would still take shipments by water and domestic mills located on the water could lay down scrap on the docks.

Cleveland . . . Hold-ups on shipments by three area mills plus two more expected shortly and another on vacation dropped prices \$2 in Cleveland and the Valley. Strike uncertainty is making bidding on local automotive lists this week a pure guessing game and bids will vary accordingly.

Birmingham . . . The steel scrap market in the South is at a standstill, with mills waiting to see outcome of contract negotiations. With possibility of a steel strike, latest purchases made had a June 22 cancellation clause on all purchases not shipped by that date.

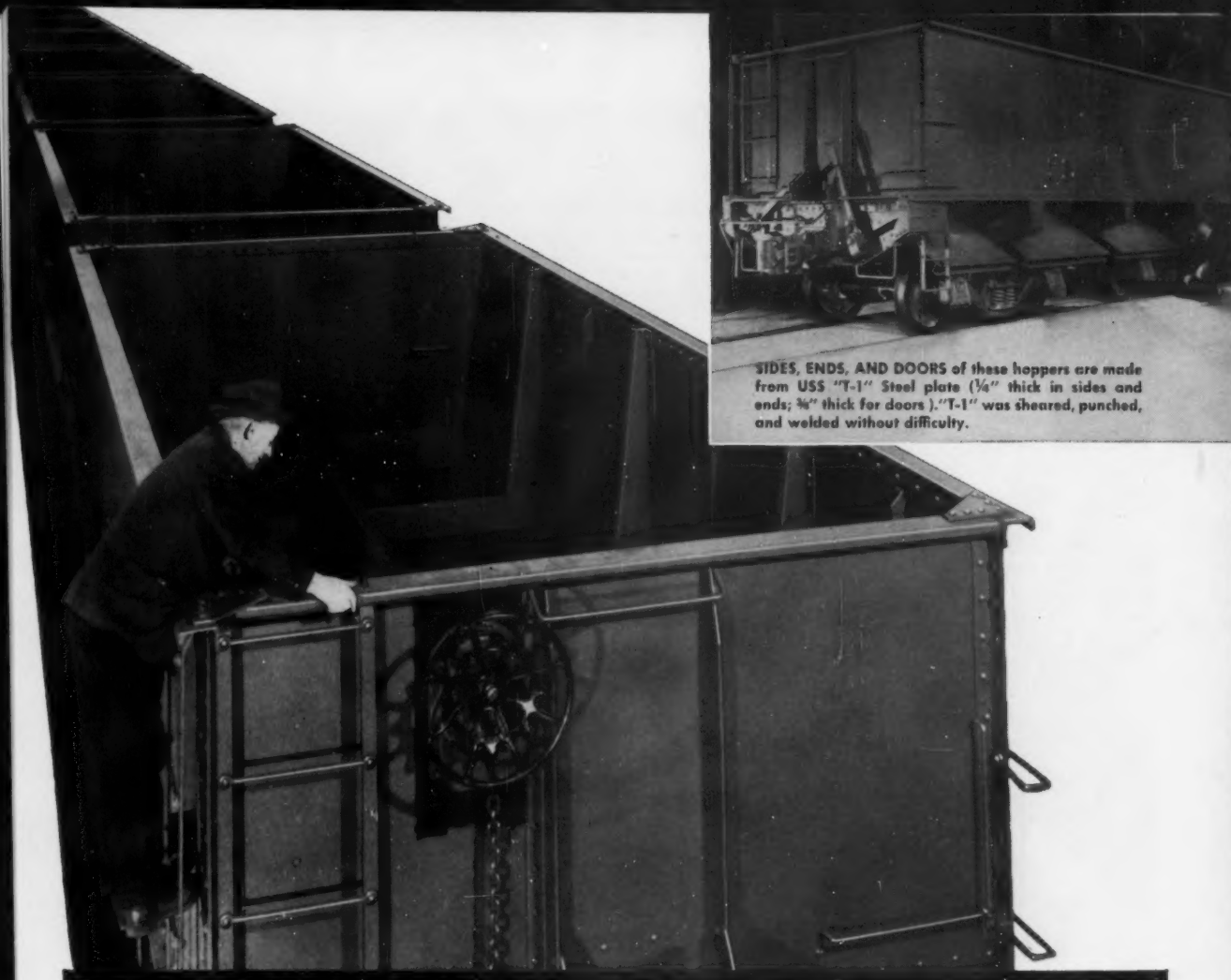
St. Louis . . . While there has been no new buying by the mills pending the outcome of wage negotiations, consumers are accepting all shipments on unfilled orders, and so far no requests have been made to withhold shipment.

Cincinnati . . . Local industrial lists being bid this week are not expected to drop too much, since major fringe area mill has no-strike history. Tonnage on major list is up to 8500 tons of bundles from 7500. One blast furnace in the area went down for re-lining last week.

Buffalo . . . Sales of scrap to major producers are at a standstill pending outcome of steel labor negotiations. The entire trade is marking time until settlement.

Boston . . . Activity in this market is non-existent. Like other markets, the effects of steel labor talks have kept activity at a minimum. Export continues weak.

West Coast . . . One mill is not taking shipments "until further notice," with its eye obviously on labor talks. Although usual summer lull is felt somewhat, prices are steady in all major markets here. No letup in brisk export market is noted.



SIDES, ENDS, AND DOORS of these hoppers are made from USS "T-1" Steel plate (1/4" thick in sides and ends; 3/8" thick for doors). "T-1" was sheared, punched, and welded without difficulty.

60 ORE CARS FOR INTERNATIONAL NICKEL CO. BUILT WITH USS "T-1" STEEL

Unique 3-way superiority of "T-1" Steel dictated choice

Copper and nickel ores are extremely hard and abrasive. Nevertheless, ore cars must last a long time. They must withstand severe corrosion, tremendous impact and abuse, day after day, for years. In the cold belt of northern Ontario, they must stay tough and durable, be able to take tremendous abuse, even at sub-zero temperatures.

The one steel that fills *all* these requirements, at the lowest cost for top performance, is USS "T-1" Steel. So International Nickel Company of Canada specified USS "T-1" for 60 new ore cars, built by Canadian Car

and Foundry Company, Limited, for use in the largest nickel mining operations in the world, in the Sudbury District, Ontario.

In these cars, USS "T-1" Steel, which has a yield strength of 90,000 psi, plus amazing ability to withstand impact at low temperatures, is expected to increase service life substantially over cars made of carbon steel. Its far greater strength and toughness and ability to withstand abrasion should materially reduce maintenance and the need for part replacement. Result: more continuous operation and lower costs.

WHERE CAN YOU USE USS "T-1"?

Look around *your* operation. If you are in the mining business, or if you're in the business of building equipment for mines, USS "T-1" has a place. In many mines today, USS "T-1" is lengthening service life, reducing weight and cost, simplifying fabrication, increasing capacity of rugged mining equipment. It can do the same for you. Write for details. Or wire, or phone. United States Steel, Room 5337, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS "T-1" CONSTRUCTIONAL ALLOY STEEL



UNITED STATES STEEL

Scrap Prices (Effective June 26, 1956)

Pittsburgh

No. 1 hvy. melting.....	\$44.00 to \$45.00
No. 2 hvy. melting.....	\$39.00 to 40.00
No. 1 bundles.....	44.00 to 45.00
No. 2 bundles.....	36.00 to 37.00
Machine shop turn.....	33.00 to 34.00
Mixed bor. and msa. turn.....	33.00 to 34.00
Shoveling turnings.....	35.00 to 37.00
Cast iron borings.....	35.00 to 37.00
Low phos. punch'g plate.....	51.00 to 52.00
Heavy turnings.....	42.00 to 43.00
No. 1 RR. hvy. melting.....	51.00 to 53.00
Scrap rails, random lgth.....	53.00 to 54.00
Rails 2 ft and under.....	56.00 to 57.00
RR. steel wheels.....	58.00 to 59.00
RR. spring steel.....	58.00 to 59.00
RR. couplers and knuckles.....	58.00 to 59.00
No. 1 machinery cast.....	54.00 to 55.00
Cupola cast.....	45.00 to 46.00
Heavy breakable cast.....	44.00 to 45.00

Chicago

No. 1 hvy. melting.....	\$43.00 to \$44.00
No. 2 hvy. melting.....	36.00 to 37.00
No. 1 factory bundles.....	49.00 to 50.00
No. 1 dealers' bundles.....	44.00 to 45.00
No. 2 dealers' bundles.....	33.00 to 34.00
Machine shop turn.....	23.00 to 24.00
Mixed bor. and turn.....	24.00 to 25.00
Shoveling turnings.....	24.00 to 25.00
Cast iron borings.....	24.00 to 25.00
Low phos. forge crops.....	54.00 to 55.00
Low phos. punch'g plate.....	53.00 to 54.00
Low phos. 3 ft and under.....	50.00 to 51.00
No. 1 RR. hvy. melting.....	50.00 to 51.00
Scrap rails, random light.....	60.00 to 61.00
Rerolling rails.....	68.00 to 69.00
Rails 2 ft and under.....	67.00 to 68.00
Locomotive tires, cut.....	55.00 to 56.00
Cut bolsters & side frames.....	55.00 to 56.00
Angles and splice bars.....	61.00 to 62.00
RR. steel car axles.....	68.00 to 70.00
RR. couplers and knuckles.....	54.00 to 55.00
No. 1 machine cast.....	47.00 to 48.00
Cupola cast.....	44.00 to 45.00
Heavy breakable cast.....	35.00 to 36.00
Cast iron brake shoe.....	35.00 to 36.00
Cast iron wheel.....	49.00 to 50.00
Malleable.....	58.00 to 59.00
Stove plate.....	40.00 to 41.00
Steel car wheels.....	54.00 to 56.00

Philadelphia Area

No. 1 hvy. melting.....	\$46.00 to \$47.00
No. 2 hvy. melting.....	37.00 to 38.00
No. 1 bundles.....	46.00 to 47.00
No. 2 bundles.....	35.00 to 36.00
Machine shop turn.....	31.00 to 32.00
Mixed bor. short turn.....	33.00 to 34.00
Cast iron borings.....	37.00 to 38.00
Shoveling turnings.....	35.00 to 36.00
Clean cast chem. borings.....	43.00 to 44.00
Low phos. 5 ft and under.....	50.00 to 51.00
Low phos. 2 ft and under.....	51.00 to 52.00
Low phos. punch'g.....	51.00 to 52.00
Elec. furnace bundles.....	49.00 to 50.00
Heavy turnings.....	45.00 to 46.00
RR. steel wheels.....	58.00 to 59.00
RR. spring steel.....	58.00 to 59.00
Rails 18 in. and under.....	63.00 to 64.00
Cupola cast.....	47.00 to 48.00
Heavy breakable cast.....	50.00 to 51.00
Cast iron car wheels.....	57.00 to 58.00
Malleable.....	64.00 to 65.00
Unstripped motor blocks.....	38.00 to 39.00
No. 1 machinery cast.....	54.00 to 55.00

Cleveland

No. 1 hvy. melting.....	\$43.00 to \$44.00
No. 2 hvy. melting.....	35.00 to 36.00
No. 1 bundles.....	43.00 to 44.00
No. 2 bundles.....	31.00 to 32.00
No. 1 busheling.....	43.00 to 44.00
Machine shop turn.....	28.00 to 29.00
Mixed bor. and turn.....	32.00 to 33.00
Shoveling turnings.....	32.00 to 33.00
Cast iron borings.....	32.00 to 33.00
Cut struct'l & plates, 3 ft & under.....	51.00 to 52.00
Drop forge flashings.....	43.00 to 44.00
Low phos. punch'g plate.....	44.00 to 45.00
Foundry steel, 2 ft & under.....	49.00 to 50.00
No. 1 RR. heavy melting.....	48.00 to 49.00
Rails 2 ft and under.....	67.00 to 68.00
Rails 18 in. and under.....	68.00 to 69.00
Railroad grade bars.....	49.00 to 50.00
Steel axle turnings.....	35.00 to 36.00
Railroad cast.....	53.00 to 54.00
No. 1 machinery cast.....	53.00 to 54.00
Stove plate.....	50.00 to 51.00
Malleable.....	59.00 to 60.00

Iron and Steel Scrap

Going prices of iron and steel scrap as obtained in the trade by THE IRON AGE based on representative tonnages. All prices are per gross ton delivered to consumer unless otherwise noted.

Youngstown

No. 1 hvy. melting.....	\$45.00 to \$46.00
No. 2 hvy. melting.....	34.00 to 35.00
No. 1 bundles.....	45.00 to 46.00
No. 2 bundles.....	32.00 to 33.00
Machine shop turn.....	27.00 to 28.00
Shoveling turnings.....	31.00 to 32.00
Cast iron borings.....	31.00 to 32.00
Low phos. plate.....	46.00 to 47.00

Buffalo

No. 1 hvy. melting.....	\$44.00 to \$45.00
No. 2 hvy. melting.....	36.00 to 37.00
No. 1 busheling.....	44.00 to 45.00
No. 1 bundles.....	44.00 to 45.00
No. 2 bundles.....	33.00 to 34.00
Machine shop turn.....	25.00 to 26.00
Mixed bor. and turn.....	27.00 to 28.00
Shoveling turnings.....	27.00 to 28.00
Cast iron borings.....	27.00 to 28.00
Low phos. plate.....	53.00 to 54.00
Scrap rails, random lgth.....	57.00 to 58.00
Rails 2 ft and under.....	65.00 to 66.00
RR. steel wheels.....	60.00 to 61.00
RR. spring steel.....	60.00 to 61.00
RR. couplers and knuckles.....	60.00 to 61.00
No. 1 machinery cast.....	50.00 to 51.00
No. 1 cupola cast.....	48.00 to 49.00

Detroit

Brokers buying prices per gross ton, on cars:	
No. 1 hvy. melting.....	\$37.00 to \$38.00
No. 2 hvy. melting.....	31.00 to 32.00
No. 1 bundles, openhearth.....	37.00 to 38.00
No. 2 bundles.....	26.50 to 27.50
New busheling.....	37.00 to 38.00
Drop forge flashings.....	36.50 to 37.50
Machine shop turn.....	19.00 to 20.00
Mixed bor. and turn.....	22.00 to 23.00
Shoveling turnings.....	22.00 to 23.00
Cast iron borings.....	22.00 to 23.00
Low phos. punch'g plate.....	37.00 to 38.00
No. 1 cupola cast.....	41.00 to 42.00
Heavy breakable cast.....	34.00 to 35.00
Stove plate.....	35.00 to 36.00
Automotive cast.....	44.00 to 45.00

St. Louis

No. 1 hvy. melting.....	\$38.00 to \$39.00
No. 2 hvy. melting.....	34.00 to 35.00
No. 1 bundles.....	35.50 to 40.50
No. 2 bundles.....	30.00 to 31.00
Machine shop turn.....	23.00 to 24.00
Cast iron borings.....	24.00 to 25.00
Shoveling turnings.....	25.00 to 26.00
No. 1 RR. hvy. melting.....	48.50 to 49.50
Rails, random lengths.....	50.00 to 51.00
Rails 18 in. and under.....	62.00 to 63.00
Locomotive tires uncut.....	50.00 to 51.00
Angles and splice bars.....	50.00 to 51.00
Std. steel car axles.....	55.00 to 57.00
RR. specialties.....	54.00 to 55.00
Cupola cast.....	46.00 to 47.00
Heavy breakable cast.....	32.00 to 33.00
Cast iron brake shoes.....	42.00 to 43.00
Stove plate.....	40.00 to 41.00
Cast iron car wheels.....	43.00 to 44.00
Rerolling rails.....	65.00 to 66.00
Unstripped motor blocks.....	32.00 to 33.00

Boston

Brokers buying prices per gross ton, on cars:	
No. 1 hvy. melting.....	\$34.00 to \$35.00
No. 2 hvy. melting.....	26.00 to 27.50
No. 1 bundles.....	34.00 to 35.00
No. 2 bundles.....	25.00 to 25.50
No. 1 busheling.....	34.00 to 35.00
Elec. furnace, 3 ft & under.....	37.00 to 38.00
Machine shop turn.....	20.00 to 20.50
Mixed bor. and short turn.....	23.00 to 23.50
Shoveling turnings.....	24.00 to 24.50
Clean cast chem. borings.....	29.00 to 30.00
No. 1 machinery cast.....	42.50 to 43.00
Mixed cupola cast.....	36.00 to 37.00
Heavy breakable cast.....	39.50 to 40.50
Stove plate.....	35.00 to 36.00
Unstripped motor blocks.....	25.50 to 26.00

New York

Brokers buying prices per gross ton, on cars:	
No. 1 hvy. melting.....	\$39.00 to \$40.00
No. 2 hvy. melting.....	30.00 to 31.00
No. 3 bundles.....	34.00 to 35.00
Machine shop turn.....	23.00 to 24.00
Mixed bor. and turn.....	23.00 to 24.00
Shoveling turnings.....	28.00 to 29.00
Clean cast chem. borings.....	29.00 to 30.00
No. 1 machinery cast.....	47.00 to 47.50
Mixed yard cast.....	44.00 to 44.50
Charging box cast.....	44.00 to 44.50
Heavy breakable cast.....	44.00 to 44.50
Unstripped motor blocks.....	33.00 to 33.50

Birmingham

No. 1 hvy. melting.....	\$34.00 to \$35.00
No. 2 hvy. melting.....	32.00 to 33.00
No. 1 bundles.....	34.00 to 35.00
No. 2 bundles.....	24.00 to 25.00
No. 1 busheling.....	24.00 to 25.00
Machine shop turn.....	25.00 to 26.00
Shoveling turnings.....	27.00 to 28.00
Cast iron borings.....	20.60 to 21.00
Electric furnace bundles.....	40.00 to 41.00
Bar crops and plate.....	51.00 to 52.00
Structural and plate, 2 ft.....	49.00 to 50.00
Scrap rails, random lgth.....	56.00 to 57.00
Rails, 18 in. and under.....	60.00 to 61.00
Angles & splice bars.....	55.00 to 56.00
Rerolling rails.....	64.00 to 65.00
No. 1 cupola cast.....	48.50 to 49.50
Stove plate.....	47.00 to 48.00
Charging box cast.....	32.00 to 33.00
Cast iron car wheels.....	39.00 to 40.00
Unstripped motor blocks.....	37.50 to 38.50
Mashed tin cans.....	15.00 to 16.00

Cincinnati

Brokers buying prices per gross ton, on cars:	
No. 1 hvy. melting.....	\$42.50 to \$43.50
No. 2 hvy. melting.....	33.50 to 34.50
No. 1 bundles.....	42.50 to 43.50
No. 2 bundles.....	31.50 to 32.50
Machine shop turn.....	25.00 to 26.00
Mixed bor. and turn.....	28.00 to 29.00
Shoveling turnings.....	29.00 to 30.00
Cast iron borings.....	28.00 to 29.00
Low phos. 18 in. & under.....	51.00 to 52.00
Rails, random lengths.....	57.00 to 58.00
Rails, 18 in. and under.....	64.00 to 65.00
No. 1 cupola cast.....	43.00 to 44.00
Hvy. breakable cast.....	43.00 to 44.00
Drop broken cast.....	52.00 to 53.00

San Francisco

No. 1 hvy. melting.....	\$43.00
No. 2 hvy. melting.....	40.00
No. 1 bundles.....	42.00
No. 2 bundles.....	35.00
No. 3 bundles.....	29.00
Machine shop turn.....	24.00
Cast iron borings.....	35.00
No. 1 RR. hvy. melting.....	43.00
No. 1 cupola cast.....	48.00

Los Angeles

No. 1 hvy. melting.....	\$42.00
No. 2 hvy. melting.....	38.00
No. 1 bundles.....	41.00
No. 2 bundles.....	31.00
No. 3 bundles.....	27.00
Machine shop turn.....	\$21.00 to 22.00
Shoveling turnings.....	24.00
Cast iron borings.....	24.00
Elec. furn. 1 ft and under.....	45.00
No. 1 RR. hvy. melting.....	42.00
No. 1 cupola cast.....	45.00

Seattle

No. 1 hvy. melting.....	\$44.00
No. 2 hvy. melting.....	40.00
No. 3 bundles.....	31.00
No. 2 bundles.....	27.00
No. 1 cupola cast.....	45.00
Mixed yard cast.....	45.00

Hamilton, Ont.

No. 1 hvy. melting.....	\$42.00
No. 2 hvy. melting.....	38.00
No. 1 bundles.....	43.00
No. 2 bundles.....	35.00
Mixed steel scrap.....	37.00
Bushings.....	35.50
Bush., new fact., prep'd.....	41.00
Bush., new fact., unprep'd.....	37.00
Machine shop turn.....	21.00
Short steel turn.....	26.00
Mixed bor. and turn.....	22.00
Rails, rerolling.....	51.00
Cast scrap.....	50.00



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All Quiet On Copper Front

Three major producers have inked new three-year contracts . . . Kennecott, Union talks amicable . . . Expect agreement soon. Odds on price cut 80-20.

♦ IT LOOKS like no major strike in domestic copper installations in 1956. Although Kennecott has not signed a new contract with the Mine, Mill and Smelter Workers yet, it is safe to count your chickens because of existing circumstances.

Kennecott must sit down to negotiate with United Steel Workers of America, representing workers in the Garfield, Utah, refinery, later in the summer. Terms of the agreement between Kennecott and MMSW, as well as result of the current steel USW sessions, will have major effect on slate USW will present to Kennecott. For this reason, talks are proceeding cautiously and slowly.

Company reports that the negotiating atmosphere is relaxed and amicable. It appears that neither side is too far out on a limb to compromise, without any loss of face.

The odds on a drop in price of producers copper, now that chances of a strike are virtually eliminated, are about 80-20. In a matter of a couple of months U. S. producers copper went from cheapest in the world to the most expensive. Thinking in the industry has been along the lines of a one-world price. Producers recently

granted wage hikes and other benefits to workers. But evidently these increased labor costs will not offset the downward trend in prices, as evident in recent developments. With the biggest stumbling block, the chance of a crippling and costly strike, disposed of for 3 years, it appears to be only a matter of time until domestic producers copper costs 43¢ per lb.

The short end of the odds would be even shorter except for the fact that external pressures have a strong effect on domestic price.

Strikes among Chile or African operations, or any other circumstance which would serve to push price up on London Metals Exchange, would relieve pressure on U. S. producers for lower price. And even this might not serve to deter a drop.

One of the normal pressures for the higher U. S. price is now missing. Chilean government is aiming its diplomatic guns across the Atlantic for a change. Most of its production for the remainder of 1956 has been sold for shipment to England and the continent at a price tied to the LME quotation. The Chilean economy is dependent on copper revenues for the lion's share of its income. Budget for 1956 is reported to

have been pegged at considerably above current LME quotation. Unless Chile can influence LME price higher, the country will be in financial difficulties by end of the year.

Continued production at mines and refineries will also serve to bring supply and demand into line.

ALUMINUM . . . For primarily seasonal reasons, demand for aluminum has leveled off, giving aluminum producers a chance to cut into their substantial backlog of orders. Output by reduction plants is reported to be increased by about 15 pct, while shipments are up 20 pct.

Supply and demand though not yet in line are showing greater promise of relative balance. Consensus is that aluminum will be readily available by last quarter.

Aluminium Ltd. will start construction immediately on a new alumina manufacturing plant in Jamaica. Full production from the new installation is expected by the middle of 1958, capacity of about 245,000 tons per year. Cost of the project will be about \$35 million.

MAGNESIUM . . . Shipments of magnesium castings continue to follow a slightly upward curve. Total for the last reported month, April, was 1570 short tons as compared to 1523 for previous month and 1316 for April 1955.

Gains were registered by sand castings, up 1.5 pct and anodes, up 28 pct. Shipments of permanent mold and die castings were off but not enough to alter the total casting uptrend.

D. T. Wellman, president of Wellman Bronze and Aluminum Co., Cleveland was re-elected president of the Magnesium Assn.

ZINC . . . Fact that steel companies are the major consumers of zinc is responsible for a currently slow zinc market. Shipments to many of the steel mills have been deferred as a precaution against a possible strike. Demand outside of steel industry also was down.

TIN . . . Despite his current recuperative status, President Eisenhower has signed a bill authorizing the government to dispose of the Texas City smelter by January 31, 1957. Since there is little likelihood of private industry purchasing the smelter, chances are that it will continue to operate for the rest of the year, with most of the output going into the stockpile.

Daily Nonferrous Metal Prices

(Cents per lb except as noted)

	June 20	June 21	June 22	June 23	June 25	June 26
Copper, electro, Conn.	46.00	46.00	46.00	46.00	46.00	46.00
Copper, Lake, delivered	46.00	46.00	46.00	46.00	46.00	46.00
Tin, Straits, New York	94.75	95.125	95.375	....	95.00	95.00*
Zinc, East St. Louis	13.50	13.50	13.50	13.50	13.50	13.50
Lead, St. Louis	15.80	15.80	15.80	15.80	15.80	15.80

Note: Quotations are going prices.

*Tentative

Rework your Monel ...it can give you years more pickling service

Look closely at this pickling crate separator pin.

See those go-nowhere threads and the weld beneath them? They tell a story. For years this piece of Monel® nickel-copper alloy has been used and re-used in pickling equipment. No one at Ingram-Richardson Manufacturing Co., Beaver Falls, Pa., can begin to tell all it has done.

But *this* they do know. Years ago they reworked the original piece. Made it and dozens of other Monel rods into separator pins. For at least 20 years, the metal has been in and out of the pickling bath.

Now look at the pin again. Sure, there are some signs of corrosion. But a nut on those Monel threads would *still* grip. And you can see the rod is sound as a dollar, good for many *more* years' service.

Wrought Monel alloy gives you important weight, safety, strength and design advantages in original equipment. After its original usefulness is dissipated, you can rework it and re-use it. Often several times.

Next time you order batch pickling fixtures, specify Monel nickel-copper alloy. In the meantime, get the newest Inco booklet, "Equipping the Pickle House." Write:

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NICKEL ALLOYS



Monel . . . for proved pickling life

Nonferrous Prices (Effective June 26, 1956)

MILL PRODUCTS

(Cents per lb, unless otherwise noted)

ALUMINUM

(Base 30,000 lb, f.o.b. ship. pt., frt. allowed)

Flat Sheet (Mill Finish) and Plate
("P" temper except 6061-0)

Alloy	.032	.081	.136- .249	.250- 3
1100, 3003....	42.3	40.2	39.0	38.0
6052.....	49.8	44.9	43.2	41.4
6061-0.....	46.9	42.7	40.9	40.8

Extruded Solid Shapes

Factor	6063 T-5	6062 T-8
6-8.....	43.1-44.8	58.1-61.7
13-14.....	43.8-45.2	59.0-63.3
24-26.....	46.8-47.2	69.2-73.6
36-38.....	55.1-55.7	92.0-95.8

Screw Machine Stock—2011-T-3

Size*	3/4	3/4-3/8	3/4-1	1 1/4-1 3/4
Price	56.0	54.9	53.6	51.6

Roofing Sheet, Corrugated

(Per sheet, 36" wide base, 16,000 lb)

Length* →	72	96	120	144
.019 gage....	\$1.310	\$1.742	\$2.175	\$2.605
.034 gage....	1.630	2.177	2.707	3.247

MAGNESIUM

(f.o.b. shipping pt., carload frt. allowed)

Sheet and Plate

Type →	Gage →	.250- 3.00	.250- 2.00	.188	.081	.032
FBI Stand. Grade.....			65.6	66.5	75	100
FBI Spec.....			55.9	61.1	103.5	163.1
Tread Plate.....			67.8	68.9		
Tooling Plate.....	70.3					

Extruded Shapes

Factor →	6-8	12-14	24-26	36-38
Comm. Grade (F5).....	66.4- 69.0	67.6- 69.6	72.1- 72.7	84.9- 85.8
Spec. Grade (A3B1B).....	81.4- 84.0	82.5- 84.6	87.1- 87.7	99.9- 100.8

Alloy Ingot

A3B1B (Die Casting)..... 35 (delivered)
A3B2A, A3B2A, A3B1C (Sand Casting) 39.35 (Velasco, Tex.)

NICKEL, MONEL, INCONEL

(Base prices, f.o.b. mill)

	"A" Nickel	Monel	Inconel
Sheet, CR.....	102	83	99
Strip, CR.....	103	93	125
Rod, Bar, HR.....	87	74	93
Angles, HR.....	87	74	93
Plate, HR.....	97	87	95
Seamless tube, 123		110	153
Shot, blocks.....		71	

COPPER, BRASS, BRONZE

(Freight included on 500 lbs)

	Sheet	Wire	Rod	Tube
Copper.....	68.63			68.83
Brass, 70/30.....	56.00	57.14		56.51
Brass, Low.....	61.35	61.89	61.29	64.16
Brass, R L.....	63.07	63.61	63.01	65.88
Brass, Naval.....	59.90	65.06	54.11	63.06
Muntz Metal.....	57.84	61.85	63.65	
Comm. Br.....	65.33	65.87	65.37	67.89
Mang. Br.....	63.54	66.19	57.04	
Phos. Br. 5%.....	86.79	84.44	87.29	

TITANIUM

(10,000 lb base, f.o.b. mill)

Sheet and strip, commercially pure, \$12.10-
\$12.60; alloy, \$16.00-\$15.75; Plate, HR, com-
mercially pure, \$10.00-\$10.50; alloy, \$11.50-
\$12.00. Wire, rolled and/or drawn, commer-
cially pure, \$9.00-\$11.50; alloy, \$11.50; Bar, HR
or forged, commercially pure, \$7.55-\$7.80; alloy,
\$7.55-\$7.75.

PRIMARY METAL

(Cents per lb, unless otherwise noted)
Aluminum ingot, 99.99%, 10,000 lb. freight alloyed \$5.90
Aluminum pig \$4.00
Antimony, American, Laredo, Tex. \$3.50
Beryllium copper, per lb cont'd Be \$43.00
Beryllium aluminum 5% Be, Dollars
per lb contained Be \$74.75
Bismuth, ton lots \$1.25
Cadmium, del'd \$1.70
Cobalt, 97-99% (per lb) \$2.60 to \$2.67
Copper, electro, Conn. Valley \$4.00
Copper, Lake, delivered \$6.00
Gold, U. S. Treas., per troy oz. \$35.00
Indium, 99.99% dollars per troy oz. \$2.25
Iridium, dollars per troy oz. \$100 to \$130
Lead, St. Louis \$5.80
Lead, New York \$6.00
Magnesium, 99.8+%, f.o.b. Velasco, Tex., 10,000 lb, pig \$3.75
Ingot \$4.50
Magnesium, sticks, 100 to 500 lb. \$6.00
Mercury, dollars per 75-lb flask, f.o.b. New York \$257 to \$259
Nickel electro \$4.50
Nickel oxide sinter at Copper Cliff, Ont., contained nickel 60.76
Palladium, dollars per troy oz. \$23 to \$24
Platinum, dollars per troy oz. \$103 to \$105
Silver, New York, cents per troy oz. 90.25
Tin, New York \$95.00
Titanium sponge, grade A-1, \$2.25 to \$2.25
Zinc, East St. Louis \$13.50
Zinc, New York \$14.00
Zirconium sponge \$10.00
*Tentative

REMETLED METALS

Brass Ingot

(Cents per lb delivered, carloads)

85-5-5-5 ingot	
No. 115.....	35.50
No. 120.....	34.25
No. 123.....	33.25
80-10-10 ingot	
No. 305.....	38.75
No. 315.....	37.00
88-10-2 ingot	
No. 210.....	50.25
No. 215.....	46.50
No. 245.....	41.50
Yellow ingot	
No. 405.....	28.75
Manganese bronze	
No. 421.....	31.25

Aluminum Ingot

(Cents per lb del'd 30,000 lb and over)

95-5 aluminum-silicon alloys	
0.30 copper max.....	25.75-26.50
0.60 copper max.....	25.50-26.25
Piston alloys (No. 122 type).....	25.25-25.75
No. 12 alum. (No. 2 grade).....	23.75-24.50
108 alloy.....	24.00-24.50
195 alloy.....	25.75-26.25
13 alloy (0.60 copper max.).....	25.50-26.50
AXS-679.....	24.00-24.50

Steel decoxidizing aluminum, notch bar granulated or shot

Grade 1—95-97 1/2%.....	24.00-24.50
Grade 2—92-95%.....	23.25-23.75
Grade 3—90-92%.....	22.50-23.00
Grade 4—85-90%.....	22.00-22.50

SCRAP METALS

Brass Mill Scrap

(Cents per pound, add 1¢ per lb for shipments of 10,000 lb and over)

	Heavy	Turnings
Copper.....	43	41 1/2
Yellow brass.....	31 1/2	29
Red brass.....	37	36 1/2
Comm. bronze.....	33 1/2	37 1/2
Mang. bronze.....	28 1/2	28 1/2
Yellow brass rod ends	31	

Custom Smelters Scrap

(Cents per pound carload lots, delivered to refinery)

No. 1 copper wire.....	33	—33 1/2
No. 2 copper wire.....	31 1/2	—32
Light copper.....	29	—29 1/2
Refinery brass.....	29	—29 1/2
*Dry copper content.....		29

Ingot Makers Scrap

(Cents per pound carload lots, delivered to refinery)

No. 1 copper wire.....	33	—33 1/2
No. 2 copper wire.....	31 1/2	—32
Light copper.....	29	—29 1/2
No. 1 composition.....	26 1/2	—26 1/2
No. 1 comp. turnings.....	26	—26 1/2
Hvy. yellow brass solids.....	18 1/2	—18 1/2
Brass pipe.....	18 1/2	—18 1/2
Radiators.....	20 1/2	—20 1/2

Aluminum

Mixed old cast.....	15	—15
Mixed new clips.....	14	—17
Mixed turnings, dry.....	15	—16

Dealers' Scrap

(Dealers' buying price, f.o.b. New York in cents per pound)

Copper and Brass

No. 1 copper wire.....	31	—31 1/2
No. 2 copper wire.....	28	—28 1/2
Light copper.....	25 1/2	—26
New type shell cuttings.....	26 1/2	—27
Auto radiators (unsweated).....	17 1/2	—18
No. 1 composition.....	23 1/2	—24
No. 1 composition turnings.....	22 1/2	—23
Unlined red car boxes.....	18 1/2	—19 1/2
Cocks and faucets.....	19	—19 1/2
Clean heavy yellow brass.....	16	—16 1/2
Brass pipe.....	21	—21 1/2
New soft brass clippings.....	22 1/2	—23
No. 1 brass rod turnings.....	20	—20 1/2

Aluminum

Alum. pistons and struts.....	6	—7
Aluminum crankcases.....	11	—11 1/2
1100 (28) aluminum clippings.....	16	—16 1/2
Old sheet and utensils.....	11	—11 1/2
Boring and turnings.....	8	—8 1/2
Industrial castings.....	11	—11 1/2
2024 (24S) clippings.....	12 1/2	—13

Zinc

New zinc clippings.....	8	—8 1/2
Old zinc.....	8	—8 1/2
Zinc routings.....	8	—8 1/2
Old die cast scrap.....	2 1/2	—3

Nickel and Monel

Pure nickel clippings.....	\$1.50-\$1.75
Clean nickel turnings.....	\$1.25
Nickel anodes.....	\$1.50-\$1.75
Nickel rod ends.....	\$1.50-\$1.75
New Monel clippings.....	75-80
Clean Monel turnings.....	60-70
Old sheet Monel.....	65-75
Nickel silver clippings, mixed	21
Nickel silver turnings, mixed	18

Lead

Soft scrap lead.....	13 1/2	—13
Battery plates (dry).....	7	—7 1/2
Batteries, acid free.....		4 1/2

Miscellaneous

Block tin.....	83	—84
No. 1 pewter.....	62 1/2	—63
Auto babbitt.....	43	—42 1/2
Mixed common babbitt.....	13 1/2	—14
Solder joints.....	18 1/2	—19
Siphon tops.....	15	—16
Small foundry type.....	15	—16
Monotype.....	16	—16 1/2
Lino. and stereotype.....	13 1/2	—14
Electrotype.....	13	—13 1/2
Hand picked type shells.....	10 1/2	—11
Lino. and stereo. dross.....	6 1/2	—6
Electro. dross.....	4 1/2	—5

IRON AGE

STEEL
PRICES(Effective
June 26, 1956)

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

		BILLETS, BLOOMS, SLABS			PIL- ING	SHAPES STRUCTURALS			STRIP					
		Carbon Re-rolling Net Ton	Carbon Forging Net Ton	Alloy Net Ton		Carbon	Hi Str. Low Alloy	Carbon Wide- Flange	Hot- rolled	Cold- rolled	Hi Str. H.R. Low Alloy	Hi Str. C.R. Low Alloy	Alloy Hot- rolled	Alloy Cold- rolled
EAST	Bethlehem, Pa.			\$96.00 B3		4.65 B3	6.80 B3	4.65 B3						
	Buffalo, N. Y.	\$68.50 B3	\$84.50 R3, B3	\$96.00 R3, B3	5.45 B3	4.65 B3	6.80 B3	4.65 B3	4.325 R3,B3	6.25 B3 6.25 R7,S10	6.425 B3	9.10 B3		
	Claymont, Del.													
	Harrison, N. J.													13.45 C11
	Conshehocken, Pa.								4.375 A2	6.30 A2	6.425 A2			
	New Bedford, Mass.									6.70 R6				
	Johnstown, Pa.	\$68.50 B3	\$84.50 B3	\$96.00 B3		4.65 B3	6.80 B3							
	Boston, Mass.									6.90 T8				13.80 T8
	New Haven, Conn.									6.70 D1 A5				
	Phoenixville, Pa.					5.15 P2		5.15 P2						
	Sparrows Pt., Md.								4.325 B3	6.25 B3	6.425 B3	9.10 B3		
	Bridgeport, Wallingford, Conn.	\$73.50 N8	\$89.50 N8						4.625 N8	6.70 W1			7.50 N8	
	Pawtucket, R. I. Worcester, Mass.									6.80 N7 A5				A5 13.80 N7
MIDDLE WEST	Alton, Ill.								4.50 L1					
	Ashland, Ky.								4.325 A7					
	Canton-Massillon, Dover, Ohio		\$86.50 R3	\$96.00 R3										13.45 G4
	Chicago, Ill.	\$68.50 U1	\$84.50 R3, U1,W8	\$96.00 R3, U1,W8	5.45 U1	4.60 U1, W8	6.75 U1, Y1	4.60 U1	4.55 A1 4.325 N4,W8	6.35 A1,T8			7.20 W8	13.45 T8
	Cleveland, Ohio									6.25 A5,J3		9.30 A5		13.45 A5
	Detroit, Mich.			\$96.00 R5					4.425 G3,M2	6.35 D1,D2, G3,M2,P11	6.525 G3	9.20 D2, G3		
	Duluth, Minn.													
	Gary, Ind. Harbor, Indiana	\$68.50 U1	\$84.50 U1	\$96.00 U1, Y1	6.45 I3	4.60 U1 I3	6.75 U1, I3		4.325 I3, U1,Y1	6.35 I3 6.25 Y1	6.425 I3, U1,Y1	9.30 Y1	7.20 Y1, U1	
	Sterling, Ill.								4.425 N4					
	Indianapolis, Ind.									6.40 C5				
	Newport, Ky.												7.20 N5	
	Middletown, Ohio									6.45 A7				
	Niles, Warren, Ohio Sharon, Pa.	\$68.50 C10	\$84.50 C1	\$96.00 C10					4.325 S1, R3	6.25 S1, R3,T4	6.425 S1, R3	9.10 S1, R3	7.20 S1	13.45 S1
WEST	Pittsburgh, Pa. Midland, Pa. Butler, Pa.	\$68.50 U1, J3	\$84.50 J3, U1,C11	\$96.00 U1, C11	5.45 U1	4.60 U1, J3	6.75 U1, J3	4.60 U1	4.325 P6	6.25 S7,B4			7.20 S9	13.45 S9
	Portsmouth, Ohio													
	Weirton, Wheeling, Follansbee, W. Va.					4.60 W3			4.325 W3	6.25 F3,W3	6.425 W3	9.10 W3		
	Youngstown, Ohio		\$84.50 C10	\$96.00 Y1, C10			6.75 Y1		4.325 U1, Y1	6.25 Y1,C5	6.425 U1, Y1	9.30 Y1	7.20 U1, Y1	13.45 C5
	Fantana, Cal.	\$78.00 K1	\$94.00 K1	\$117.00 K1		5.30 K1	7.40 K1	5.45 K1	5.125 K1	8.00 K1	7.575 K1		8.95 K1	
	Genova, Utah		\$84.50 C7			4.60 C7	6.75 C7							
	Kansas City, Mo.					4.70 S2	6.85 S2				6.675 S2		7.45 S2	
	Los Angeles, Torrance, Cal.		\$94.00 B2	\$116.00 B2		5.30 C7, B2	7.45 B2		5.875 C7 B2	8.30 C1			8.40 B2	
	Minnequa, Colo.					4.90 C6			5.425 C6					
	Portland, Ore.					5.35 O2								
SOUTH	San Francisco, Niles, Pittsburg, Cal.		\$94.00 B2			5.25 B2, P9	7.40 B2		5.875 B2, C7					
	Seattle, Wash.		\$98.00 B2			5.35 B2	7.50 B2		5.325 B2					
	Atlanta, Ga.								4.525 A8					
	Fairfield, Ala. City, Birmingham, Ala.	\$68.50 T2	\$84.50 T2			5.10 C16 4.60 R3,T2	6.75 T2		4.325 R3,T2 4.825 C10		6.425 T2			
	Houston, Lone Star, Texas	\$74.50 L3	\$89.50 S2	\$101.00 S2		4.70 S2	6.85 S2				6.675 S2		7.45 S2	

IRON AGE

STEEL
PRICES(Effective
June 26, 1956)

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

	SHEETS									WIRE ROD	TINPLATE†		BLACK PLATE
	Hot-rolled 18 ga. & heavier	Cold- rolled	Galvanized 10 ga.	Enamel ing 12 ga.	Long Tern 10 ga.	Hi Str. Low Alloy H.R.	Hi Str. Low Alloy C.R.	Hi Str. Low Alloy Galv.	Hot rolled 19 ga.		Cokes* 1.25-lb. base box	Electro* 0.25-lb. base box	Holloware Enameling 29 ga.
EAST	Bethlehem, Pa.												
	Buffalo, N. Y.	4.325 B3	5.325 B3			6.375 B3	7.875 B3			5.375 W6	† Special coated milg. terne deduct 50¢ from 1.25-lb. coke base box price. Can-making quality blackplate 55 to 128 lb. deduct \$2.20 from 1.25-lb. coke base box. * COKE: 1.50-lb. add 25¢. ELECTRO: 0.50-lb. add 25¢; 0.75-lb. add 65¢; 1.00-lb. add \$1.00. Differ- ential 1.00 lb./0.25 lb. add 65¢.		
	Claymont, Del.												
	Colesville, Pa.												
	Conshohocken, Pa.	4.375 A2	5.375 A2			6.425 A2							
	Harrisburg, Pa.												
	Hartford, Conn.												
	Johnstown, Pa.									5.375 B3			
	Fairless, Pa.	4.375 U1	5.375 U1			6.425 U1	7.925 U1				\$9.70 U1	\$8.40 U1	
	New Haven, Conn.												
	Phoenixville, Pa.												
	Spartanburg, S.C.	4.325 B3	5.325 B3	5.85 B3		6.375 B3	7.875 B3	8.60 B3		5.475 B3	\$9.70 B3	\$8.40 B3	
	Worcester, Mass.									5.675 A5			
MIDDLE WEST	Trenton, N. J.												
	Alton, Ill.									5.55 L1			
	Ashland, Ky.	4.325 A7		5.85 A7	5.90 A7								
	Canton-Massillon, Dover, Ohio			5.85 R1, R3									
	Chicago, Joliet, Ill.	4.55 A1 4.325 W8				6.375 U1				5.375 N4 5.375 A5, R3			
	Sterling, Ill.									5.475 N4			
	Cleveland, Ohio	4.325 J3, R3	5.325 J3, R3		5.90 R3	6.375 J3, R3	7.875 J3, R3			5.375 A5			
	Detroit, Mich.	4.425 G3, M2	5.425 G3, 5.325 M2			6.475 G3	7.975 G3						
	Newport, Ky.	4.325 N5	5.325 N5	5.85 N5									
	Gary, Ind. Harbor, Indiana	4.325 J3, U1, Y1	5.325 J3, U1, Y1	5.85 U1, J3	5.90 U1, J3	6.25 U1	6.375 Y1, U1, J3	7.875 U1, Y1		5.375 Y1	\$9.60 U1, Y1	\$8.30 J3, U1, Y1	6.65 U1, Y1
	Granite City, Ill.	4.525 G2	5.525 G2	6.05 G2	6.10 G2							\$8.40 G2	6.75 G2
	Kokomo, Ind.			5.95 C9						5.475 C9			
	Mansfield, Ohio	4.325 E2	5.325 E2			6.25 E2							
	Middletown, Ohio		5.325 A7	5.85 A7	5.90 A7	6.25 A7							
	Niles, Warren, Ohio Sharon, Pa.	4.325 S1, R3, N3	5.325 R3, N3	5.85 R3 6.85 N3	5.90 N3	6.25 N3	6.375 S1, R3	7.875 R3				\$8.30 R3	
	Pittsburgh, Pa. Midland, Pa. Butler, Pa.	4.325 J3, U1, P6	5.325 J3, U1, P6	5.85 U1	5.90 U1, A7	6.375 J3, U1	7.875 U1	8.60 U1		5.625 P6 5.375 A5	\$9.60 J3, U1	\$8.30 J3, U1	6.65 U1
	Portsmouth, Ohio	4.325 P7	5.325 P7							5.375 P7			
	Weirton, Wheeling, Follinsbee, W. Va.	4.325 W3, W5	5.325 W3, W5, F3	5.85 W3, W5		6.25 W3, W5	6.375 W3	7.875 W3			\$9.60 W3, W5	\$8.30 W3, W5	6.65 F3, W5
	Youngstown, Ohio	4.325 U1, Y1	5.325 Y1		5.90 Y1	6.375 U1, Y1	7.875 Y1			5.375 Y1			
WEST	Fontana, Cal.	5.125 K1	6.525 K1			7.175 K1	9.075 K1				\$10.35	\$9.05	\$7.75
	Geneva, Utah	4.425 C7											
	Kansas City, Mo.									5.625 S2			
	Los Angeles, Torrance, Cal.									6.175 B2			
	Minneapolis, Colo.									5.625 C6			
	San Francisco, Niles, Pittsburg, Cal.	5.025 C7	6.275 C7	6.60 C7						5.675 C7	\$10.35 C7	\$9.05 C7	
	Seattle, Wash.												
SOUTH	Atlanta, Ga.												
	Fairfield, Ala. Alabama City, Ala.	4.325 R3, T2	5.325 T2	5.85 R3, T2		6.375 T2				5.625 R3 5.375 T2	\$9.70 T2	\$8.40 T2	
	Houston, Tex.									5.625 S2			

IRON AGE

STEEL PRICES

(Effective June 26, 1956)

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

	BARS						PLATES				WIRE
	Carbon Steel	Reinforcing	Cold Finished	Alloy Hot-rolled	Alloy Cold Drawn	Hi Str. H.R. Low Alloy	Carbon Steel	Flat Plate	Alloy	Hi Str. Low Alloy	Mfr's. Bright
EAST	Bethlehem			5.575 B3	7.425 B3	6.80 B3					
	Buffalo, N. Y.	4.65 B3,R3	4.65 B3,R3	6.30 B5	5.575 B3,R3	7.425 B3,B5	6.80 B3	4.50 B3,R3			6.60 W6
	Claymont, Del.							5.35 C4		6.30 C4	6.725 C4
	Coatesville, Pa.							4.80 L4		6.30 L4	6.725 L4
	Coshohocken, Pa.							4.50 A2	5.575 A2		6.725 A2
	Harrisburg, Pa.							5.10 P2	5.575 C3		
	Hartford, Conn.		6.75 R3		7.725 R3						
	Johnstown, Pa.	4.65 B3	4.65 B3		5.575 B3	6.80 B3	4.50 B3		6.30 B3	6.725 B3	6.60 B3
	Fairless, Pa.	4.80 U1	4.80 U1		5.725 U1						
	Newark, N. J.			6.70 W10		7.60 W10					
	Camden, N. J.			6.70 P10							
	Bridgeport, Putnam, Conn.	4.80 N8		6.80 W10	5.725 N8		4.750 N8				
	Sparrows Pt., Md.		4.65 B3				4.50 B3		6.30 B3	6.725 B3	6.70 B3
	Palmer, Worcester, Readville, Mass. Milton, Pa.	4.80 M7	4.80 M7	6.70 W11 6.45 C14 6.70 B5	7.725 A5,B5		4.50 R3				6.90 A5 6.90 W6
	Spring City, Pa.			6.35 K4	7.60 K4						
MIDDLE WEST	Alton, Ill.	4.85 L1									6.775 L1
	Ashland, Newport, Ky.						4.50 A7,N5		6.30 N5		
	Canton-Masillon, Mansfield, Ohio	4.75 R3		6.25 R2,R3	5.575 R3,T5	7.425 R2,R3,T5	4.50 E1				
	Chicago, Joliet, Ill.	4.65 U1, N4,W8,R3, 5.15 P13	4.65 N4,R3, 5.15 P13	6.25 B5,W8, W10,A5,L2	5.575 U1,R3, W8	7.425 A5,W8, W10,L2,B5	4.50 U1,W8, J3,R3 4.725 A1	5.575 U1	6.30 U1	6.725 U1	6.60 A5,R3, N4,W7
	Cleveland, Ohio	4.65 R3	4.65 R3	6.25 A5,C13		7.425 A5,C13	6.80 R3	4.60 J3,R3	5.575 J3	6.725 R3,J3	6.60 A5, C13
	Detroit, Mich.	4.75 G3	4.75 G3	5.90 R5 6.45 B5 6.50 P3 6.10 P8	5.575 R5 5.675 G3	7.425 R5 7.625 B5,P3, P8	6.90 G3	4.60 G3		6.825 G3	
	Duluth, Minn.										6.60 A3
	Gary, Ind. Harbor, Crawfordville	4.65 J3,U1, Y1	4.65 J3,U1, Y1	6.25 M5,R3	5.575 J3,U1, Y1	7.425 M5, R3	6.80 U1,J3, Y1	4.50 J3,U1, Y1	5.575 J3	6.30 U1,Y1	6.725 U1, J3,Y1
	Granite City, Ill.						4.70 G2				
	Kokomo, Ind.										6.70 C9
	Sterling, Ill.	4.75 N4	4.75 N4								6.70 N4
	Niles, Warren, Ohio Sharon, Pa.	4.65 R3,C10		6.25 C10	5.75 C10	7.425 C10	6.80 R3	4.50 S1,R3	6.30 S1	6.725 S1	
	Pittsburgh, Pa. Midland, Pa.	4.65 J3,U1, C11	4.65 J3,U1	6.25 A5,C8, C11,J3, W10,B4,R3	5.575 U1,C11	7.425 A5,C11, W10,C8,R3	6.80 J3,U1	4.50 J3,U1	5.575 U1	6.30 U1	6.60 A5,J3, P6
	Portsmouth, Ohio										6.60 P7
WEST	Weirton, Wheeling, Follinsbee, W. Va.	4.65 W3					4.50 W3,W5				
	Youngstown, Ohio	4.65 U1,Y1, C10,R3	4.65 U1,Y1, R3	6.25 Y1,U1	5.575 U1,Y1, C10	7.425 Y1,C10, F2	6.80 U1,Y1	4.50 U1,Y1, R3	6.30 Y1	6.725 Y1	6.60 Y1
	Emeryville, Cal.	5.40 J5	5.40 J5								
	Fontana, Cal.	5.35 K1	5.35 K1		6.625 K1	7.50 K1	5.20 K1		7.00 K1	7.375 K1	
	Geneva, Utah						4.50 C7			6.725 C7	
	Kansas City, Mo.	4.90 S2	4.90 S2		5.825 S2	7.05 S2					6.85 S2
	Los Angeles, Torrance, Cal.	5.35 B2,C7	5.35 B2,C7	7.70 R3	6.625 B2	7.50 B2				7.625 B2	7.55 B2
	Minnequa, Colo.	5.10 C6	5.10 C6				5.35 C6				6.85 C6
	Portland, Ore.	5.40 O2	5.40 O2								
	San Francisco, Niles, Pittsburg, Cal.	5.35 C7 5.40 B2,P9	5.35 C7 5.40 B2,P9			7.55 B2					7.55 C7 7.55 C6
	Seattle, Wash.	5.40 B2,P12, N6	5.40 B2,P12			7.55 B2	5.40 B2		7.20 B2	7.625 B2	
	Atlanta, Ga.	5.15 A8	5.15 A8								6.90 A8
	Fairfield, Ala. City, Birmingham, Ala.	4.65 T2,R3 5.15 C16	4.65 T2,R3 5.15 C16			6.80 T2	4.50 T2,R3			6.725 T2	6.60 R3,T2
	Houston, Ft. Worth, Leno S'ar, Tex.	4.90 S2	4.90 S2		5.825 S2	7.05 S2	4.85 L3 4.60 S2		6.40 S2	6.825 S2	6.85 S2

Steel Prices (Effective June 26, 1956)

Key to Steel Producers

With Principal Offices

- A1 Acme Steel Co., Chicago
A2 Alan Wood Steel Co., Conshohocken, Pa.
A3 Allegheny Ludlum Steel Corp., Pittsburgh
A4 American Cladmetals Co., Carnegie, Pa.
A5 American Steel & Wire Div., Cleveland
A6 Angell Nail & Chaplet Co., Cleveland
A7 Armco Steel Corp., Middletown, Ohio
A8 Atlantic Steel Co., Atlanta, Ga.
B1 Babcock & Wilcox Tube Div., Beaver Falls, Pa.
B2 Bethlehem Pacific Coast Steel Corp., San Francisco
B3 Bethlehem Steel Co., Bethlehem, Pa.
B4 Blair Strip Steel Co., New Castle, Pa.
B5 Bliss & Laughlin, Inc., Harvey, Ill.
B6 Brock Plant, Wickwire Spencer Steel Div., Birdsboro, Pa.
C1 Calstrip Steel Corp., Los Angeles
C2 Carpenter Steel Co., Reading, Pa.
C3 Central Iron & Steel Co., Harrisburg, Pa.
C4 Claymont Products Dept., Claymont, Del.
C5 Cold Metal Products Co., Youngstown, O.
C6 Colorado Fuel & Iron Corp., Denver
C7 Columbia Geneva Steel Div., San Francisco
C8 Columbia Steel & Shifting Co., Pittsburgh
C9 Continental Steel Corp., Kokomo, Ind.
C10 Copperweld Steel Co., Pittsburgh, Pa.
C11 Crucible Steel Co. of America, Pittsburgh
C12 Cumberland Steel Co., Cumberland, Md.
C13 Cuyahoga Steel & Wire Co., Cleveland
C14 Compressed Steel Shifting Co., Readville, Mass.
C15 C. O. Carlson, Inc., Thorndale, Pa.
C16 Connors Steel Div., Birmingham
C17 Chester Blast Furnace, Inc., Chester, Pa.
D1 Detroit Steel Corp., Detroit
D2 Detroit Tube & Steel Div., Detroit
D3 Driver Harris Co., Harrison, N. J.
D4 Dickson Weatherproof Nail Co., Evanston, Ill.
D5 Henry Diaston & Sons, Inc., Philadelphia
E1 Eastern Stainless Steel Corp., Baltimore
E2 Empire Steel Co., Mansfield, O.
F1 Firth Sterling, Inc., McKeesport, Pa.
F2 Fitzsimmons Steel Corp., Youngstown
F3 Follansbee Steel Corp., Follansbee, W. Va.
G1 Globe Iron Co., Jackson, O.

- G2 Granite City Steel Co., Granite City, Ill.
G3 Great Lakes Steel Corp., Detroit
G4 Greer Steel Co., Dover, O.
H1 Hanna Furnace Corp., Detroit
I2 Ingersoll Steel Div., Chicago
I3 Inland Steel Co., Chicago
I4 Interlake Iron Corp., Cleveland
J1 Jackson Iron & Steel Co., Jackson, O.
J2 Jessop Steel Corp., Washington, Pa.
J3 Jones & Laughlin Steel Corp., Pittsburgh
J4 Joslyn Mfg. & Supply Co., Chicago
J5 Judson Steel Corp., Emeryville, Calif.
K1 Kaiser Steel Corp., Fontana, Cal.
K2 Keystone Steel & Wire Co., Peoria
K3 Koppers Co., Granite City, Ill.
K4 Keystone Drawn Steel Co., Spring City, Pa.
L1 Laclede Steel Co., St. Louis
L2 La Salle Steel Co., Chicago
L3 Lone Star Steel Co., Dallas
L4 Lukens Steel Co., Coatesville, Pa.
M1 Mahoning Valley Steel Co., Niles, O.
M2 McLouth Steel Corp., Detroit
M3 Mercer Tube & Mfg. Co., Sharon, Pa.
M4 Mid-States Steel & Wire Co., Crawfordsville, Ind.
M5 Monarch Steel Div., Hammond, Ind.
M6 Mystic Iron Works, Everett, Mass.
M7 Milton Steel Products Div., Milton, Pa.
N1 National Supply Co., Pittsburgh
N2 National Tube Div., Pittsburgh
N3 Niles Rolling Mill Div., Niles, O.
N4 Northwestern Steel & Wire Co., Sterling, Ill.
N5 Newport Steel Corp., Newport, Ky.
N6 Northwest Steel Rolling Mills, Seattle
N7 Newman Crosby Steel Co., Pawtucket, R. I.
N8 Northeastern Steel Corp., Bridgeport, Conn.
O1 Oliver Iron & Steel Co., Pittsburgh
O2 Oregon Steel Mills, Portland
P1 Page Steel & Wire Div., Monessen, Pa.
P2 Phoenix Iron & Steel Co., Phoenixville, Pa.
P3 Pilgrim Drawn Steel Div., Plymouth, Mich.
P4 Pittsburgh Coke & Chemical Co., Pittsburgh
P5 Pittsburgh Screw & Bolt Co., Pittsburgh
P6 Pittsburgh Steel Co., Pittsburgh
P7 Portsmouth Div., Detroit Steel Corp., Detroit
P8 Plymouth Steel Co., Detroit

- P9 Pacific States Steel Co., Niles, Cal.
P10 Precision Drawn Steel Co., Camden, N. J.
P11 Production Steel Strip Corp., Detroit
P12 Pacific Steel Rolling Mills, Seattle
P13 Phoenix Mfg. Co., Joliet, Ill.
R1 Reeves Steel & Mfg. Co., Dover, O.
R2 Reliance Div., Eaton Mfg. Co., Massillon, O.
R3 Republic Steel Corp., Cleveland
R4 Roebbing Sons Co., John A., Trenton, N. J.
R5 Rotary Electric Steel Co., Detroit
R6 Rodney Metals, Inc., New Bedford, Mass.
R7 Rome Strip Steel Co., Rome, N. Y.
S1 Sharon Steel Corp., Sharon, Pa.
S2 Sheffield Steel Corp., Kansas City
S3 Shenango Furnace Co., Pittsburgh
S4 Simonds Saw and Steel Co., Fitchburg, Mass.
S5 Sweet's Steel Co., Williamsport, Pa.
S6 Standard Forging Corp., Chicago
S7 Stanley Works, New Britain, Conn.
S8 Superior Drawn Steel Co., Monaca, Pa.
S9 Superior Steel Corp., Carnegie, Pa.
S10 Seneca Steel Service, Buffalo
T1 Tonawanda Iron Div., N. Tonawanda, N. Y.
T2 Tennessee Coal & Iron Div., Fairfield
T3 Tennessee Products & Chem. Corp., Nashville
T4 Thomas Strip Div., Warren, O.
T5 Timken Steel & Tube Div., Canton, O.
T6 Tremont Nail Co., Warcham, Mass.
T7 Texas Steel Co., Fort Worth
T8 Thompson Wire Co., Boston
U1 United States Steel Corp., Pittsburgh
U2 Universal-Cyclops Steel Corp., Bridgeville, Pa.
U3 Ulbrich Stainless Steels, Wallingford, Conn.
U4 U. S. Pipe & Foundry Co., Birmingham
W1 Wallingford Steel Co., Wallingford, Conn.
W2 Washington Steel Corp., Washington, Pa.
W3 Weirton Steel Co., Weirton, W. Va.
W4 Wheatland Tube Co., Wheatland, Pa.
W5 Wheeling Steel Corp., Wheeling, W. Va.
W6 Wickwire Spencer Steel Div., Buffalo
W7 Wilson Steel & Wire Co., Chicago
W8 Wisconsin Steel Co., S. Chicago, Ill.
W9 Woodward Iron Co., Woodward, Ala.
W10 Wyckoff Steel Co., Pittsburgh
W11 Worcester Pressed Steel Co., Worcester, Mass.
W12 Wallace Barnes Steel Div., Bristol, Conn.
Y1 Youngstown Sheet & Tube Co., Youngstown, O.

PIPE AND TUBING

Base discounts (per) f.o.b. mills. Base price about \$200 per net ton.

STANDARD T. & C.	BUTTWELD												SEAMLESS											
	1/4 In.		3/4 In.		1 In.		1 1/4 In.		1 1/2 In.		2 In.		2 1/2-3 In.		2 In.		2 1/2 In.		3 In.		3 1/2-4 In.			
	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.	Bk.	Gal.		
Sparrows Pt. B3.....	16.50	1.25	19.50	5.25	22.00	8.75	24.50	9.50	25.00	10.50	25.50	11.00	27.00	10.75										
Youngstown R3.....	18.50	1.25	21.50	5.25	24.00	8.75	26.50	10.00	27.00	11.00	27.50	11.50	29.00	11.75										
Fontana K1.....	6.00	13.25	9.00	+9.25	11.50	+5.75	14.00	+4.00	14.50	+3.00	15.00	+2.50	16.50	+1.75										
Pittsburgh J3.....	18.50	1.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75	4.00	+11.	10.50	+6.25	13.00	+3.75	14.50	+2.25		
Alton, Ill. L1.....	16.50	1.25	19.50	5.25	22.00	8.75	24.50	9.50	25.00	10.50	25.50	11.00	27.00	10.75										
Sharon M1.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75										
Fairless N2.....	16.50	1.25	19.50	5.25	22.00	8.75	24.50	9.50	25.00	10.50	25.50	11.00	27.00	10.75										
Pittsburgh N1.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75	4.00	+11.	10.50	+6.25	13.00	+3.75	14.50	+2.25		
Wheeling W5.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75										
Wheatland W4.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75										
Youngstown Y1.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75	4.00	+11.	10.50	+6.25	13.00	+3.75	14.50	+2.25		
Indiana Harbor Y1.....	17.50	2.25	20.50	6.25	23.00	9.75	25.50	10.00	26.00	11.50	26.50	12.00	28.00	11.75										
Lorain N2.....	18.50	3.25	21.50	7.25	24.00	10.75	26.50	11.50	27.00	12.50	27.50	13.00	29.00	12.75	4.00	+11.	10.50	+6.25	13.00	+3.75	14.50	+2.25		
EXTRA STRONG PLAIN ENDS																								
Sparrows Pt. B3.....	21.00	7.25	25.00	11.25	27.00	14.75	27.50	13.50	28.00	14.50	28.50	15.00	29.00	13.75										
Youngstown R3.....	23.00	7.25	27.00	11.25	29.00	14.75	29.50	14.00	30.00	15.00	30.50	15.50	31.00	14.75										
Fairless N2.....	21.00	7.25	25.00	11.25	27.00	14.75	27.50	13.50	28.00	14.50	28.50	15.00	29.00	13.75										
Fontana K1.....	10.50		14.50		16.50		17.00		17.50		18.00		18.50											
Pittsburgh J3.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75	5.50	+8.50	13.00	+2.75	15.50	+0.25	20.50	4.75		
Alton, Ill. L1.....	21.00	7.25	25.00	11.25	27.00	14.75	27.50	13.50	28.00	14.50	28.50	15.00	29.00	13.75										
Sharon M1.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75										
Pittsburgh N1.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75	5.50	+8.50	13.00	+2.75	15.50	+0.25	20.50	4.75		
Wheeling W5.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75										
Wheatland W4.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75										
Youngstown Y1.....	23.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75	5.50	+8.50	13.00	+2.75	15.50	+0.25	20.50	4.75		
Indiana Harbor Y1.....	22.00	8.25	26.00	12.25	28.00	15.75	28.50	14.50	29.00	15.50	29.50	16.00	30.00	14.75										
Lorain N2.....	21.00	9.25	27.00	13.25	29.00	16.75	29.50	15.50	30.00	16.50	30.50	17.00	31.00	15.75	5.50	+8.50	13.00	+2.75	15.50	+0.25	20.50	4.75		

Threads only, butt-weld and seamless 2 1/4 pt. higher discount. Plain ends, butt-weld and seamless, 3-in. and under, 5 1/2 pt. higher discount. Galvanized discounts based on zinc price range of over 9¢ to 11¢ per lb. East St. Louis. For each 2¢ change in zinc, discounts vary as follows: 1/2, 3/4 and 1-in., 2 pt.; 1 1/4, 1 1/2 and 2-in., 1 1/2 pt.; 2 1/2 and 3-in., 1 pt., e.g., zinc price range of over 11¢ to 13¢ would lower discounts; zinc price in range over 9¢ to 11¢ would increase discounts. East St. Louis zinc price now 13.50¢ per lb.

TOOL STEEL

F.o.b. mill

W	Cr	V	Mo	Co	per lb	SAE
18	4	1	—	—	\$1.60	T-1
18	4	1	—	5	2.505	T-4
18	4	3	—	—	1.765	T-9
1.5	4	1.5	8	—	.96	M-1
6	4	3	6	—	1.35	M-8
6	4	3	6	—	1.105	M-2

High-carbon chromium... .77 D-3, D-5
Oil hardened manganese .42 O-2
Special carbon .39 W-1
Extra carbon .33 W-1
Regular carbon .275 W-1
Warehouse prices on and east of Mississippi are 4¢ per lb higher. West of Mississippi, 6¢ higher.

CLAD STEEL

Base prices, cents per lb. f.a.b.

Cladding	Plate (A3, J2, L4)			Sheet (J2)	
	10 pct	15 pct	20 pct	20 pct	
304	38.30	33.15	34.85	32.50	
316	35.50	38.45	41.40	47.00	
321	32.00	34.85	37.75	37.25	
347	34.40	37.90	41.40	48.25	
405	25.80	29.60	33.35		
416, 438	25.30	29.10	32.85		

CR Strip (S9) Copper, 10 pct, 2 sides, 42.15; 1 side, 33.40.

WARE-HOUSES

Cities	City Delivery Charge	Sheets		Strip		Plates Shapes		Bars		Alloy Bars			
		Hot-Rolled	Cold-Rolled	Galvanized (10 gage)	Hot-Rolled	Cold-Rolled	Standard Structural	Hot-Rolled	Cold-Finished	Hot-Rolled 4615 As rolled	Hot-Rolled 4140 Annealed	Cold-Drawn 4615 As rolled	Cold-Drawn 4140 Annealed
Baltimore	\$.10	7.31	8.32	8.37	7.65	7.63	7.93	7.61	8.62	14.38	13.44-13.96	16.36	16.29-16.49
Birmingham	.15	6.89	7.93	8.85	7.06	6.99	7.28	7.08	9.35				
Boston	.10	8.22	9.17	10.42	8.31	8.51	8.37	8.37	9.96		13.76		16.81
Buffalo	.15	7.35	8.40	10.16	7.50	7.80	7.75	7.50	8.05		13.65		16.70
Chicago	.15	7.28	8.39	9.25	7.36	7.60	7.58	7.42	7.90		13.30		16.35
Cincinnati	.15	7.40	8.38	9.25	7.60	7.89	8.05	7.68	8.30	13.59	13.55	16.44	16.60
Cleveland	.15	7.28	8.39	9.10	7.46	7.77	7.91	7.68	8.15	13.41	13.36	16.26	16.41
Denver		8.40	10.76	11.22	8.90	8.60	8.75	8.90	9.82				17.97
Detroit	.15	7.47	8.58	9.53	7.64	7.88	8.05	7.70	8.19	13.70	13.54	16.55	16.59
Houston		7.85	8.75	10.49	8.15	8.00	8.20	8.25	10.10	14.35	15.90	17.15	17.05
Kansas City	.20	7.47	8.76	9.17	7.73	7.66	7.95	7.75	8.52	13.87	13.52	16.72	16.57
Los Angeles	.10	8.25	10.10	11.10	8.60	8.85	8.60	8.25	11.00		14.50		18.10
Memphis	.10	7.12	8.25		7.38	7.31	7.60	7.40	9.15				
Milwaukee	.15	7.37	8.48	9.34	7.45	7.60	7.75	7.51	8.09		13.39		16.44
New Orleans	.15	7.28	8.35		7.45	7.40	7.70	7.50	9.55				
New York	.10	7.88	8.98	9.73	8.33	8.31	8.21	8.28	9.87		13.67		16.72
Norfolk	.20	7.25			7.65	7.45	7.95	7.65	9.50				
Philadelphia	.10	7.44	8.54	9.51	8.09	7.82	7.85	7.83	8.62		13.45		16.50
Pittsburgh	.15	7.28	8.39	9.55	7.46	7.60	7.58	7.42	8.15	13.85	13.30	16.25	16.35
Portland		7.80-8.80-10.65		8.60	7.95	7.75	7.85-8.15	7.95	12.20		15.00		17.50
Salt Lake City	.20			10.60		9.35	9.20	9.15					
San Francisco	.10	8.30	9.75	10.25	8.45	8.40	8.35	8.25	11.55		14.50		18.10
Seattle	.00	8.75	10.50	10.90	8.90	8.50	8.50	8.60	12.25		14.75		17.80
St. Louis	.15	7.57	8.68	9.54	7.65	7.89	7.98	7.71	8.44		13.59		16.64
St. Paul	.25	7.94	8.59-9.14		9.09	7.72	7.65	7.94	7.74	8.51		13.51	16.31

Base Quantities (Standard unless otherwise keyed): Cold finished bars: 2000 lb or over. Alloy bars: 1000 to 1999 lb. All others: 2000 to 9999 lb. All HR products may be combined for quantity. All galvanized sheets may be combined for quantity. CR sheets may not be combined with each other or with galvanized sheets for quantity.
Exceptions: (1) 1600 to 9999 lb. (2) 1000 lb or over, (3) \$25 delivery. (4) 1000 to 1999 lb, \$25 delivery.

*Plus analysis charge. †Deduct for country delivery.

ELECTRICAL SHEETS

22-Gage F.a.b. Mill Cents Per Lb	Hot-Rolled (Cut Lengths)*	Cold-Reduced (Coiled or Cut Length)	
		Semi-Processed	Fully Processed
Field	8.40	8.60	.....
Armature	9.35	9.60	10.10
Elect.	9.95	10.20	10.70
Motor	10.95	11.20	11.70
Dynamo	11.85	12.10	12.60
Trans. 72	12.00	13.05	13.55
Trans. 65	13.35	Grain Oriented	
Trans. 58	13.85	Trans. 80	17.45
Trans. 52	14.85	Trans. 73	17.95

Producing points: Beech Bottom (W5); Brackenridge (A3); Granite City (G7); Indiana Harbor (I3); Mansfield (E2); Newport, Ky. (N5); Niles, O. (N3); Vandergrift (U1); Warren, O. (R5); Zanesville (A7).
* Coils 75¢ higher.

LAKE SUPERIOR ORES

51.50% Fe natural content, delivered lower Lake ports. Prices for 1956 season. Freight changes for seller's account.

	Gross Ton
Openhearth lump	\$12.10
Old range, bessemer	11.25
Old range, nonbessemer	11.10
Mesabi, bessemer	11.00
Mesabi, nonbessemer	10.85
High phosphorus	10.85

Metropolitan Price, dollars per 100 lb.

MERCHANT WIRE PRODUCTS

F.a.b. Mill	Standard & Coated Nails		Woven Wire		Fence 8-15 1/2 in.		Fence Posts		Single Loop Bale Ties		Cable, Bunched and Twisted		Merch. Wire Anvil		Merch. Wire Calc.	
	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal
Alabama City R3	152	162	173	175	7.40	7.00										
Aliquippa, Pa. J3	152	162	173	175	7.40	7.00										
Atlanta A8	154	167	177	180	7.60	8.125										
Bartonsville K2*	154	168	175	181	7.60	8.28										
Buffalo W6	152	166	175	178	7.50	7.90										
Chicago, Ill. N4**	152	166	175	178	7.50	8.10										
Cleveland A6	157	170	180	187	7.40	8.05										
Cleveland A5	154	168	177	181	7.60	8.20										
Crawfordsville M6*	152	162	175	175	7.50	7.90										
Donora, Pa. A5	152	162	175	175	7.50	7.90										
Duluth A5	152	162	175	175	7.50	7.90										
Fairfield, Ala. T2	152	162	175	175	7.50	7.90										
Galveston D4	157	170	180	187	7.40	8.05										
Houston S2	157	170	180	187	7.40	8.05										
Johnstown, Pa. B3*	152	166	175	175	7.40	7.80										
Joliet, Ill. A5	152	162	175	175	7.50	8.10										
Kokomo, Ind. C9	154	154	177	177	7.60	8.00										
Los Angeles B2*	157	167	178	180	7.65	8.05										
Kansas City S2	157	167	178	180	7.65	8.05										
Anniqua C6	157	167	178	180	7.65	8.05										
Minneapolis P6	152	162	175	175	7.40	7.90										
Medina, Ill. R3	152	162	175	175	7.40	7.90										
Pittsburg, Cal. C7	171	185	199	195	8.45	8.85										
Portsmouth P7	152	162	175	175	7.40	7.90										
Rankin, Pa. A5	152	162	175	175	7.40	7.90										
So. Chicago R3	152	162	175	175	7.40	7.90										
S. San Francisco C6	157	167	178	180	7.65	8.05										
Sparks, Pa. B3*	154	164	175	181	7.60	8.20										
Struthers, O. YL	159	169	179	184	7.50	8.00										
Worcester A5	159	169	179	184	7.50	8.20										
Williamsport, Pa. S5	160	170	180	185	7.40	7.90										

Galvanized products computed with zinc at 5¢ per lb. Exceptions: * zinc at 12.5¢ per lb.; ** 13¢ zinc.

C-R SPRING STEEL

Cents Per Lb F.a.b. Mill	CARBON CONTENT				
	0.28-0.40	0.41-0.60	0.61-0.80	0.81-1.05	1.06-1.35
Bristol, Conn. W12		10.90	13.05	15.75	
Buffalo, N. Y. R7	7.00	8.95	10.50	12.65	15.35
Carnegie, Pa. S9		9.95	10.60	12.75	15.35
Cleveland A5	7.10	9.05	10.60	12.75	15.45
Detroit D1	7.20	9.15	10.70	12.85	
Detroit D2	7.20	9.15	10.70		
Harrison, N. J. C11		10.90	13.05	15.75	
Indianapolis C5	7.15	9.10	10.50	12.65	15.35
New Castle, Pa. B4	7.00	8.95	10.50	12.65	
New Haven, Conn. D1	7.55	9.35	10.90	13.05	
Pawtucket, R. I. N7	7.65	9.35	10.90	13.05	15.75
Pittsburgh S7	7.10	9.05	10.60	12.75	15.45
Riverdale, Ill. A1	7.20	9.05	10.60	12.75	15.45
Sharon, Pa. S1	7.10	9.05	10.60	12.75	15.45
Trenton R4		10.90	13.05	15.75	
Wallington W1	7.55	9.35	10.90	13.05	15.75
Warren, Ohio T4	7.00	8.95	10.50	12.65	15.35
Wornton, W. Va. W3	7.10	8.95	10.50		
Worcester, Mass. A5	7.65	9.35	10.90	13.05	15.75
Youngstown C5	7.00	8.95	10.50	12.65	15.35

BOILER TUBES

\$ per 100 ft. exclud lots, cut 10 to 24 ft. F.a.b. Mill	Size		Seamless		Elec. Weld	
	OD-In.	B.W. Ga.	H.R.	C.D.	H.R.	C.D.
Babcock & Wilcox.	2	13	32.09	37.37	29.93	
	2½	12	43.22	50.31	40.31	
	3	12	49.90	58.10	46.55	
	3½	11	58.26	67.83	54.34	
	4	10	77.36	90.07	72.17	
National Tube	2	13	32.09	37.37	29.93	
	2½	12	43.22	50.31	40.31	
	3	12	49.90	58.10	46.55	
	3½	11	58.26	67.83	54.34	
	4	10	77.36	90.07	72.17	
Pittsburgh Steel . . .	2	13	32.09	37.37		
	2½	12	43.22	50.31		
	3	12	49.90	58.10		
	3½	11	58.26	67.83		
	4	10	77.36	90.07		

RAILS, TRACK SUPPLIES

F.o.b. Mill Cents Per Lb.	No. 1 Std. Rails	Light Rails	Joint Bars	Track Spikes	Screw Spikes	Tie Plates	Track Bolts Untreated
Beasomer U1	4.725	5.65	5.825				
So. Chicago R3				8.05			
Ensley T2	4.725	5.65					
Fairfield T2		5.65	8.05		5.625		
Gary U1	4.725	5.65			5.625		
Ind. Harbor T3	4.725		5.825	8.05	5.625		
Ind. Harbor Y1				8.05			
Johnstown B5		5.65					
Juliet U1			5.825				
Kansas City S2				7.90			
Lackawanna B9	4.725	5.65	5.825		5.625		
Lebanon B3						12.15	
Minnequa C6	4.725	6.15	5.825	7.90		5.625	12.15
Pittsburgh O1					11.90		12.15
Pittsburgh P5							12.15
Seattle B2				8.40			12.65
Steele B3	4.725		5.825		5.625		
Struthers Y1				8.05			
Terrance C7					5.775		
Williamsport S5		5.65					
Youngstown R3				8.05			

COKE

Furnace, beehive (f.o.b. oven)	Net-Ton
Connellsville, Pa.	\$14.50
Foundry, beehive (f.o.b. oven)	
Connellsville, Pa.	\$17.00 to \$18.00
Foundry, oven coke	
Buffalo, del'd	\$28.75
Chicago, f.o.b.	27.00
Detroit, f.o.b.	27.50
New England, del'd	28.55
Seaboard, N. J., f.o.b.	26.75
Philadelphia, f.o.b.	26.50
Swedeland, Pa., f.o.b.	26.50
Painesville, Ohio, f.o.b.	27.50
Erie, Pa., f.o.b.	27.50
Cleveland, del'd	29.43
Cincinnati, del'd	28.59
St. Paul, f.o.b.	26.50
St. Louis, f.o.b.	26.50
Birmingham, f.o.b.	25.65
Lone Star, Tex., f.o.b.	19.50

ELECTRODES

Cents per lb f.o.b. plant, threaded, with nipples, unboxed.

GRAPHITE			CARBON*		
Diam. (in.)	Length (in.)	Price	Diam. (in.)	Length (in.)	Price
24	84	23.00	40	106, 110	9.90
20	72	22.25	35	110	9.90
16 to 18	72	22.50	30	110	10.95
14	72	23.00	24	72 to 84	10.30
12	72	23.50	20	90	10.10
10	60	24.25	17	72	10.35
7	60	24.50	14	72	10.85
4	60	27.25	12	60	11.75
3	40	30.25	10	60	11.90
2 1/2	30	32.75	8	60	12.10
2	24	52.50			

* Prices shown cover carbon nipples.

ELECTROPLATING SUPPLIES

Anodes	
(Cents per lb, f.o.b. shipping point)	
Copper	
Cast elliptical, 18 in. or longer,	
5000 lb lots	64.42
Electrodeposited	56.78
Brass, 80-20, ball anodes, 2000 lb	
or more	60.00
Zinc, ball anodes, 2000 lb lots	21.25
(for elliptical add 2¢ per lb)	
Nickel, 99 pct plus, rolled carbon	90.50
(rolled depolarized add 3¢ per lb)	
Cadmium	\$1.70
Tin, ball anodes and elliptical	\$1.10 to \$1.10
Chemicals	
(Cents per lb, f.o.b. shipping point)	
Copper cyanide, 100 lb drum	\$3.50
Copper sulphate, 5 or more 100 lb	
bags, per cwt	\$1.15
Nickel salts, single, 4-100 lb bags	\$3.25
Nickel chloride, freight allowed,	
300 lb	43.50
Sodium cyanide, domestic, fob N. Y.	
200 lb drums	21.55
(Philadelphia price \$1.80)	
Zinc cyanide, 100 to 900 lb	55.55
Potassium cyanide, 100 lb drum	
N. Y.	48.00
Chromic acid, flake type, 1 to 20	
100 lb drums	30.25

BOLTS, NUTS, RIVETS, SCREWS

(Base discount, f.o.b. mill)

Machine and Carriage Bolt

	Discounts	
	Full case	Full case
	20,000 lb.	Quantity or more
1/2 in. & smaller x 6 in. & shorter	61	63
Larger than 1/2 in. diam. and all diam. longer than 6 in.	55	57
1/2 in. & smaller x 6 in. and shorter	61	63
Lag, all diam. x 6 in. & shorter	61	63
Lag, all diam. longer than 6 in.	55	57
Plow bolts	61	63

Nuts, Hex, HP, reg. & hvy.

1/2" or smaller	64	66
1/2" to 1 1/4" inclusive	63	65
1 1/4" to 1 3/4" inclusive	65	67
1 3/4" and larger	61	63

C.P. Hex, regular & hvy.

1/2" or smaller	64	66
1/2" and larger	61	63

Hot Galv. Nuts (all types)

1 1/2" or smaller	44	47
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Finished, Semi-finished, Hex Nuts

1/2" and smaller	66	66
1/2" and larger	63	63

Add 25% for less than case or keg quantity.

Rivets

	Base per 100 lb	
	Pot Off List	
1/2 in. and larger	\$9.95	
7/16 in. and smaller	\$9	

Cap Screws

	Discount	
	Bright Treated	H.C. Heat
New std. hex head, pack- aged		
1/2" thru 1 1/2" diam. x 6"		
and shorter	34	20
9/16" and 5/8" x 6" and smaller and shorter	31	16
1", 1 1/4", 1 1/2" x 6" and shorter	9	+11
New std. hex head, bulk*		
1/2" thru 1 1/2" diam. x 6"		
and shorter	49	41
9/16" and 5/8" diam. x 6"		
and shorter	43	39
1", 1 1/4", 1 1/2" x 6" and shorter	31	20
*Minimum quantity per item:		
15,000 pieces 1/2", 5/16", 3/8" diam.		
5,000 pieces 7/16", 1/2", 9/16", 5/8" diam.		
2,000 pieces 3/4", 1" diam.		

Machine Screws & Stove Bolts

		Discount	
		Mach. Screws	Stove Bolts
Packaged, package list . . .		27	38
Bulk, bulk list			
	Quantity		
1/4-in. diam. & under	} 25,000-200,000	20	61
5/16-in. diam. & larger		20	61
All diam. over 3 in. long	} 5,000-100,000	—	61

Machine Screw & Stove Bolt Nuts

		Discount	
		Hex	Square
Packaged, package list . . .		24	27
Bulk, bulk list			
	Quantity		
1/2-in. diam. & smaller	25,000-200,000	18	20

CAST IRON WATER PIPE INDEX

Birmingham	113.1
New York	125.6
Chicago	127.6
San Francisco-L. A.	134.8

Dec. 1955 value Class B or heavier 6 in. or larger, bell and spigot pipe. Explanation: p. 57, Sept. 1 issue. Source: U. S. Pipe and Foundry Co.

REFRACTORIES

Fire Clay Brick	Carloads per 1000
First quality, Ill., Ky., Md., Mo., Ohio, Pa. (except Salina, Pa., add \$5.00)	\$122.00
No. 1 Ohio	
Sec. quality, Pa., Md., Ky., Mo., Ill.	114.00
No. 2 Ohio	98.00
Ground fire clay, net ton, bulk (except Salina, Pa., add \$1.50)	15.00

Silica Brick

Mt. Union, Pa., Ensley, Ala.	\$128.00
Childs, Hays, Pa.	138.00
Chicago District	138.00
Western Utah	144.00
California	151.00
Super Duty	
Hays, Pa., Athens, Tex., Wind- ham, Warren, O.	145.00
Curtner, Calif.	163.00
Silica cement, net ton, bulk, East- ern (except Hays, Pa.)	21.00
Silica cement, net ton, bulk, Hays, Pa.	24.00
Silica cement, net ton, bulk, Chi- cago District, Ensley, Ala.	22.00
Silica cement, net ton, bulk, Utah and Calif.	32.00

Chrome Brick

Standard chemically bonded, Balt.	Per net ton
Standards chemically bonded, Curt- ner, Calif.	\$91.00
Burned, Balt.	101.25
	85.00

Magnesite Brick

Standard Baltimore	\$114.00
Chemically bonded, Baltimore	102.00

Grain Magnesite

Domestic, f.o.b. Baltimore	St. %-in. grains
in bulk fines removed	\$64.00
Domestic, f.o.b. Chewelah, Wash., Luning, Nev.	
in bulk	40.00
in sacks	46.00

Dead Burned Dolomite

F.o.b. bulk, producing points in:	Per net ton
Pa., W. Va., Ohio	\$15.00
Midwest	15.00
Missouri Valley	14.00

METAL POWDERS

Per pound, f.o.b. shipping point, in ton lots, for minus 100 mesh.	
Swedish sponge iron c.i.f.	
New York, ocean bags ...	9.50¢
Canadian sponge iron,	
Del'd in East, carloads ...	9.5¢
Domestic sponge iron, 98+%	
Fe, carload lots	9.5¢
Electrolytic iron, annealed,	
Imported 99.5+ % Fe	27.5¢
domestic 99.5+ % Fe	26.5¢
Electrolytic iron, unannealed	
minus 325 mesh, 99+ % Fe	57.0¢
Electrolytic iron melting	
stock, 99.84% pure	22.0¢
Carbonyl iron size 5 to 10	
micron, 98%, 00.5+ % Fe.	\$5.00 to \$11.55
Aluminum freight allowed	38.00¢
Brass, 10 ton lots	\$7.50¢ to \$8.00¢
Copper, electrolytic	59.50¢
Copper, reduced	59.50¢
Cadmium, 100-199 lb. 95¢ plus metal value	
Chromium, electrolytic 99.95%	
min. Fe .03 max. Del'd.	\$5.00
Lead	\$3.90¢ plus metal value
Manganese	70.0¢
Molybdenum, 99%	\$3.00 to \$3.25
Nickel, unannealed	\$1.00
Nickel, annealed	\$1.00
Nickel, spherical, unannealed,	
#20	\$1.18
Silicon	43.50¢
Solder powder, .70¢ to 9.0¢ plus met. value	
Stainless steel, 302	99.0¢
Stainless steel, 316	\$1.32
Tin	14.00¢ plus metal value
Tungsten, 99% (65 mesh)	\$4.50
Zinc, 10 ton lots	18.75¢ to 22.50¢

Ferroalloy Prices

(Effective June 26, 1956)

Ferrochrome

Contract prices, cents per lb contained			
Cr, lump, bulk carloads, del'd, 67-71% Cr, 30-1.00% max. Si			
0.02% C	39.25	0.20% C	36.25
0.03% C	38.75	0.50% C	36.00
0.06% C	37.25	1.00% C	35.25
0.10% C	36.75	1.50% C	35.10
0.15% C	36.50	2.00% C	35.00
4.00-4.50% C, 67.70% Cr, 1-2% Si	26.25		
3.50-5.00% C, 67-64% Cr, 2.00-4.50% Si	25.00		
0.025% C (Simplex)	32.50		
0.10% C, 50-52% Cr, 2% max. Si	33.75		
8.50% max. C, 50-55% Cr, 3-6% Si	22.50		
8.50% C, 50-55% Cr, 3% max. Si	22.50		

High Nitrogen Ferrochrome

Low-carbon type 0.75% N. Add 5¢ per lb to regular low carbon ferrochrome price schedule. Add 5¢ for each additional 0.25% of N.

Chromium Metal

Contract prices, per lb chromium contained, packed, delivered, ton lots, 97% min. Cr, 1% max. Fe	
0.10% max. C	\$1.27
0.50% max. C	1.27
9 to 11% C, 33-91% Cr, 0.75% Fe	1.36

Electrolytic Chromium Metal

Contract prices per lb of metal 2" x D plate (1/4" thick) delivered packed, 99.80% min. Cr. (Metallic Base) Fe 0.20 max.	
Carloads	1.25
Ton lots	1.27
Less ton lots	1.29

Low Carbon Ferrochrome Silicon

(Cr 34-41%, Si 42-45%, C 0.05% max.)	
Contract price, carloads, delivered, lump, 3-in. x down, per lb of Cr, packed.	
Carloads	41.35
Ton lots	46.15
Less ton lots	48.65

Calcium-Silicon

Contract price per lb of alloy, lump, delivered, packed.	
30-33% Cr, 60-65% Si, 3.00 max. Fe.	
Carloads	23.00
Ton lots	25.25
Less ton lots	26.75

Calcium-Manganese-Silicon

Contract prices, cents per lb of alloy, lump, delivered, packed.	
16-20% Ca, 14-18% Mn, 53-59% Si	
Carloads	23.05
Ton lots	24.95
Less ton lots	25.95

SMZ

Contract prices, cents per pound of alloy, delivered, 60-65% Si, 5-7% Mn, 5-7% Zr, 20% Fe 1/2 in. x 12 mesh.	
Ton lots	19.65
Less ton lots	20.90

V Foundry Alloy

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis, V-5; 38-42% Cr, 17-19% Si, 8-11% Mn, packed.	
Carload lots	17.20
Ton lots	18.70
Less ton lots	19.95

Graphidex No. 4

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis, Si 48 to 52%, Ti 9 to 11% Ca 5 to 7%.	
Carload packed	18.50
Ton lots to carload packed	19.65
Less ton lots	20.90

Ferromanganese

Maximum contract base price, f.o.b., lump size, base content 74 to 76 pct Mn. Cents per-lb

Producing Point	
Marletta, Ashtabula, O.; Alloy, W. Va.; Sheffield, Ala.; Portland, Ore.	10.75
Johnstown, Pa.	10.75
Sheridan, Pa.	10.75
Philo, Ohio	10.75
S. Duquesne	10.75
Add or subtract 0.1¢ for each 1 pct Mn above or below base content.	
Briquets, delivered, 66 pct Mn:	
Carloads, bulk	13.00
Ton lots packed	15.20

Spiegeleisen

Contract prices, per gross ton, lump, f.o.b. Falmerton, Pa.	
Manganese Silicon	
16 to 19% 3% max.	\$92.00
19 to 21% 3% max.	94.00
21 to 23% 3% max.	96.50

Manganese Metal

Contract basis, 2 in. x down, cents per pound of metal, delivered.	
95.50% min. Mn, 0.2% max. C, 1% max. Si, 2.5% max. Fe.	
Carload, packed	45.75
Ton lots	47.25

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, f.o.b. Marietta, O., delivered, cents per pound.	
Carloads	31.5
Ton lots	33.5
250 to 1999 lb	35.5
Premium for hydrogen-removed metal	0.75

Medium Carbon Ferromanganese

Mn 80 to 85%, C 1.25 to 1.50, Si 1.50% max. Contract price, carloads, lump, bulk, delivered, per lb of contained Mn...	
	22.85

Low-Carb Ferromanganese

Contract price, cents per pound Mn contained, lump size, del'd Mn 85-90%.			
	Carloads	Ton	Less
0.07% max. C, 0.06% P, 90% Mn	34.00	36.55	37.75
0.07% max. C	31.95	34.50	35.70
0.10% max. C	31.20	33.75	34.95
0.15% max. C	30.45	33.00	34.20
0.30% max. C	28.95	31.50	32.70
0.50% max. C	28.45	31.00	32.20
0.75% max. C, 80-85% Mn, 5.0-7.0% Si	25.45	28.00	29.20

Silicomanganese

Contract basis, lump size, cents per pound of metal, 65-68% Mn, 18-20% Si, 1.5% max. C for 2% max. C, deduct 0.2¢ f.o.b. shipping point.	
Carload bulk	12.00
Ton lots	13.45
Briquet contract basis carloads, bulk, delivered, per lb of briquet	13.55
Ton lots, packed	15.75

Silvery Iron (electric furnace)

Si 15.50 to 18.00 pct, f.o.b. Keokuk, Iowa, or Wenatchee, Wash., \$100.00 gross ton, freight allowed to normal trade area.	
Si 15.01 to 15.50 pct, f.o.b. Niagara Falls, N. Y., \$93.00.	

Silicon Metal

Contract price, cents per pound contained Si, lump size, delivered, packed.		
	Ton lots	Carloads
96.50% Si, 2% Fe	22.75	21.45
98% Si, 1% Fe	23.25	21.95

Silicon Briquets

Contract price, cents per pound of briquets, bulk, delivered, 40% Si, 2 lb Si. briquets.	
Carloads, bulk	7.15
Ton lots, packed	9.75

Electric Ferrosilicon

Contract price, cents per lb contained Si, lump, bulk, carloads, f.o.b. shipping point.			
50% Si	12.75	75% Si	15.40
65% Si	14.50	85% Si	17.10
90% Si	18.50		

Calcium Metal

Eastern zone contract prices, cents per pound of metal, delivered.			
	Cast	Turnings	Distilled
Ton lots	\$2.05	\$2.95	\$3.75
Less ton lots	2.40	3.30	4.55

Ferrovanadium

50-55% V contract, basis, delivered, per pound, contained V, carloads, packed.	
Openhearth	3.10
Crucible	3.20
High speed steel (Primos)	3.30

Alsifer, 20% Al, 40% Si, 40% Fe. Contract basis, f.o.b. Suspension Bridge, N. Y., per lb.

Carloads	10.65¢
Ton lots	11.80¢

Calcium molybdate, 43.6-46.6% f.o.b. Langeloth, Pa., per pound Contained Mo

	\$1.34
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Ferrocolumbium, 50-60%, 2 in. x D contract basis, delivered per pound contained Cb.

Ton lots	\$6.90
Less ton lots	6.95

Ferro-tantalum-columbium, 20% Ta, 40% Cb, 0.30% C, contract basis, del'd, ton lots, 2-in. x D per lb cont Sb plus Ta

	\$4.65
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Ferromolybdenum, 55-75%, 200-lb containers, f.o.b. Langeloth, Pa., per pound contained Mo

	\$1.54
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Ferrophosphorus, electric, 23-26%, car lots, f.o.b. Siglo, Mt. Pleasant, Tenn., \$4.00 unitage, per gross ton

10 tons to less carload	\$110.00
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Ferrotitanium, 40% regular grade, 0.10% C max., f.o.b. Niagara Falls, N. Y., and Bridgeville, Pa., freight allowed, ton lots, per lb contained Ti

	\$1.35
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Ferrotitanium, 25% low carbon, 0.10% C max., f.o.b. Niagara Falls, N. Y., and Bridgeville, Pa., freight allowed, ton lots, per lb contained Ti

	\$1.50
Less ton lots	1.55

Ferrotitanium, 15 to 18% high carbon, f.o.b. Niagara Falls, N. Y., freight allowed, carload, per net ton

	\$200.00
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Ferrotungsten, 1/4 x down, packed, per pound contained W, ton lots, delivered

	\$3.45
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Molybde oxide, briquets, per lb contained Mo, f.o.b. Langeloth, Pa.

	\$1.32
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bagas, f.o.b. Washington, Pa. Langeloth, Pa.

	\$1.30
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Stannal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio, freight allowed, per lb.

Carload, bulk lump	17.50¢
Ton lots, packed lump	19.50¢
Less ton lots	20.00¢

Vanadium oxide, 86-89% V₂O₅ contract basis, per pound contained V₂O₅

	\$1.33
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Zirconium contract basis, per lb of alloy

35-40% f.o.b. freight allowed, carloads, packed	26.25¢
12-15%, del'd lump, bulk-carloads	8.50¢

Boron Agents

Borasil, contract prices per lb of alloy del. f.o.b. Philo, Ohio, freight allowed, B 3.14%, Si

40-45%, per lb contained 2	\$5.25
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Bortan, f.o.b. Niagara Falls

Ton lots, per pound	45¢
Less ton lots, per pound	50¢

Corbortan, Ti 15-21%, B 1-2%, Si 2-4%, Al 1-2%, C 4.5-7.5% f.o.b. Suspension Bridge, N. Y., freight allowed

Ton lots per pound	14.00¢
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Ferroboreon, 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C, 1 in. x D, ton lots

F.o.b. Wash., Pa.; Niagara Falls, N. Y., delivered 100 lb up	
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10 to 14% B	.85
14 to 19% B	1.20
19% min. B	1.50

Grntal, f.o.b. Bridgeville, Pa., freight allowed, 100 lb and over

No. 1	\$1.05
No. 79	50¢

Manganese - Boron, 75.00% Mn., 15.20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C, 2 in. x D, del'd

Ton lots	\$1.48
Less ton lots	1.57

Nickel-Boron, 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni, del'd less ton lots

	\$2.05
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RAILWAY EQUIPMENT FOR SALE

Used - As Is - Reconditioned

RAILWAY CARS

All Types

SERVICE-TESTED

FREIGHT CAR REPAIR PARTS

For All Types of Cars

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Diesel, Steam, Gasoline,
Diesel-Electric

SPECIAL OFFERING

31 — ALL-STEEL ORE CARS,
HOPPER TYPE

40 and 50-ton capacity
Excellent condition. Immediate delivery!

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Covered Hopper Cars
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or STEEL"**

THE CLEARING HOUSE

News of Used and Rebuilt Machinery

Boom Is On . . . West Coast used machinery dealers are beating the bushes for equipment to sell. Booming industrial growth has them scurrying all over the country for machines. Their customers need a wide variety of lathes, mills, and sheet metal equipment. And they'll even take some stuff in halfway decent condition.

In the Los Angeles area dealers need: shears, press brakes, No. 4 to No. 6 mills, big turret lathes, and grinders. These items have carried the "most needed" tag for several months.

Sheet Equipment Popular . . .

Used sheet metal equipment is also finding an excellent market. The construction industry, a big user, keeps pounding on the dealer's door for more. The market will get even tighter. You can count on that. Why? Other big users, the guided missile and electronics industries, are going like a house on fire.

Dealers Pleased . . . Los Angeles used machinery people seem unanimous in feeling that 1956 will be their best year ever. And in the San Francisco Bay area, people in the business are also happy. They're anxious to tell the world that business is great. Here are sample answers to the "How's business?" question:

"The first five months were excellent. And there'll be good business for the balance of the year. Sales volume is up about 35 pct so far. And our 12-month total will wind up quite a bit better."

"I'm proud of the way things have been for the past year and for the last month in particular. I haven't felt any of the drop-off reported in other parts of the country. The high level of prosperity now being enjoyed by the used machinery people here should continue for several years. Can't see how it can be otherwise with

all the new industry coming into the area—Lockheed Aircraft, General Electric, Sperry Gyroscope, atomic energy projects and others."

On Best Seller List . . .

San Francisco Bay area's best sellers: horizontal and vertical lathes, radial drills, press brakes, shears, and milling machines. Only good quality equipment finds a ready market here.

Prices are still going up, most dealers report, but the rate of ascent has slowed considerably. Some hard-to-get items bring as much as 80 pct the cost of new.

Dealers seem to be buying heaviest in Chicago, Cincinnati, and the East Coast cities. Order backlog on good stuff ranges around six weeks on lighter machinery to six months on heavier equipment.

Scarcity in North . . . Foreign tools still are popular with some dealers. Others report lagging sales on this equipment. Why? Users like to get replacement parts promptly.

In the Seattle area, there's hardly any good used equipment around. Some "junk" machinery is available for which there's little demand. Most critical item: lathes.

Prices are on the up side in Seattle. Suppliers are beginning to pass along the anticipated steel price increase. It's too early to determine the exact hike, but the signs are there.

Good First Quarter . . . Sales of used and rebuilt metalworking machine tools during the period of January to March were 42 pct better than in the corresponding period in 1955, reports the Machinery Dealers National Association.

The healthy condition of business in the used equipment field is indicated by the fact that these first quarter sales were 12.3 pct over fourth quarter of last year.

CONSIDER GOOD USED EQUIPMENT FIRST

BENDER

2500 Wallace Hydr. Bender 180", Cap'y 2 1/2"

BENDING ROLLS

0" x 2 1/2" Niagara, Initial Type
10" x 10 Ga. Bertuch, Initial Type
12" x 3/4" Cleveland Pyramid Type
16" x 3/4" Niles Pyramid Type
27" x 1" Southward Pyramid Type

BRACKS—LEAF TYPE

10" x 10 Ga. Dreis & Krump No. 204

10" x 10 Ga. Dreis & Krump Hand Operated

12" x 3/4" Dreis & Krump

12" x 3/4" Dreis & Krump, Motor Driven

12" x 3/16" Cincinnati

BULLDOZERS

#5 Williams & White, 20" Stroke, 1 1/2" x 68" Face of Crosshead

#27 Williams & White, 22" Stroke 16" x 89" Face of Crosshead

CRANES—OVERHEAD ELECTRIC TRAVELING

5 ton P&H 25" Span 230 Volt D.C.

5 ton Shepard Niles 55" Span 220 Volt D.C.

5 ton P&H 80" Span 220/3/60 A.C.

5 ton P&H 80" Span 220/3/60 A.C.

5 ton Cleveland 96" Span 220 Volt D.C.

10 ton Cyclops 48" Span 220/440 A.C.

10 ton P&H 77" Span 220 Volt D.C.

10 ton Milwaukee 88" Span 220 Volt D.C.

10 ton P&H 96" Span 220 Volt D.C.

12" ton Hand Oper. 100" Span

120 ton Whiting 88" Span 220/3/60 A.C.

CUT OFF MACHINES

Yoder AD-2 Cut-Off, Max. Capacity 3/4" O.D.

Yoder Type L Flying Cut-Off, Cap'y 3/4" to 3" Tubing

FORGING MACHINE

1" to 5" Acme, Ajax, National

HAMMERS BOARD DROP—STEAM DROP

STEAM FORGING—600 lb. to 20,000 lb.

LATHE—TURRET

#24 Warner & Swasey Univ. Type M 510 Proselector

Head, LATE

LEVELLERS—ROLLER

60" United 17 Rolls 3/4" Dia.

72" McKay 17 Rolls 4/4" Dia.

84" McKay Type B, 17 Rolls 5/4" Dia.

MULTI SLIDE MACHINE

No. 55 U. S. Multi Slide Machine with Edgewise

Stock Straightener

PLANNER—OPEN SIDE

48" x 48" x 12" Cincinnati, Three Head

PRESS—HYDRAULIC

530 ton Baldwin Southwark 12" stroke 48" x 25"

Between Columns

1257 ton Baldwin Southwark Forging Press, 20"

Stroke Main Ram, 54" x 41" Rec. Columns

4500 ton B-L-H Hydr. Forging Press

PRESS—STRAIGHT SIDE

Clearing Model TFI1500-200 Triple Acting Strokes

40, 32, 14", Bed Area 160" x 200"

PUNCH & SHEAR COMBINATIONS

Style EF Cleveland 36" Throat, Punch 1 1/4" thru 1"

Style W Cleveland 60" Throat, 312 Ton

2 1/2" Buffalo, Notcher, Punch 1-1/16" x 3/4", Shear

Angles 1 & 2 x 9/16", etc.

Pels LUSEFF, Punch 1 1/4" x 1", Shear Angles 6 x

6 x 3/4", Hd. 2 1/4", Sq. 3/4", etc.

ROLLING MILLS

10" x 18" Single Stand, Two High

12" x 16" Pals, Single Stand, Two High

12" x 20" Standard Single Stand, Two High

15" x 28" Farrel Single Stand, Two High

15" x 36" G & M Single Stand, Two High

16" x 24" Farrel Two Stand, Two High

22" x 12" x 40" Lewis 3-High Sheet Mill

12" Three High Bar Mill

30" x 54" United Single Stand, Two High

8" Torrington Ring Type Reversing Mill

For cold reducing 7" wide strip

ROLLS FORMING

8 Stand Maplewood, Spindle 2" Dia., 12" Dist. be-

tween spindles

SHEAR—BAR

Pels Type 18-22, Capacity 2" Rd., 1 1/4" Sq.

SHEAR—BILLET

No. 7 Hilles & Jones, Motor Drive, Cap. 5" Sq.

SHEARS—GATE

80" x 3/4" Pels

84" x 1 1/2" Hilles & Jones

SHEAR—ANGLE

6 x 6 x 3/4" Cleveland

SHEARS—SQUARING

12" x 3/4" Niagara, NEW 1951

12" x 3/4" Steelwell

SLITTERS

36" Yoder Slitting Line

G-48 Yoder Gang Slitter, 5" Threaded Arbor

STRAIGHTENERS

Kane & Roach 2 Roll Rotary Straightener, M.D.

Capacity Mildsteel 1/4" to 3/4"

Kane & Roach 5 Roll #2500-B, Capacity 3/4" to 2 1/4"

Solid, 4 1/2" Tube

Acton Standard 12 Roll Straightener, Capacity 3"

SWAGING MACHINE

#6 1/4 Fenn, Capacity 3/4" Tube, 3 1/4" Solid 10"

Die Length, Hydraulic Feed, LATE

TESTING MACHINES

60,000, 100,000, 200,000 Olsen & Riehle Universal

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REBUILT — GUARANTEED ELECTRICAL EQUIPMENT

MOTOR GENERATOR SETS

Qu.	KW	Make	D.C. R.P.M.	Volts	A.C. Volts
1	2500	Whse.	720	600	4160/2300
1	2000	Al. Ch.	720	250	4160/2300
1	1200	Whse.	720	600	2300
1	1120	Elliot	720	380/280	2300
1	500	G.E.	1200	250	2300/440
1	500	Ch. Wh.	720	475/480	2300/440
1	800	G.E.	1200	250/275	2300
1	300	Elliot	1200	125	4000/2300
1	150	G.E.	1200	250	2300/440
1	120	Whse.	1200	250	2300/440
1	100	Al. Ch.	1200	250	4000/2300

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	Volts	R.P.M.
2	3000	Whse.	Mill	525	600
6	1500	Whse.	Mill	525	600
4	700	Whse.	Mill	250	800/700
2	600	Al. Ch.	Mill	600	800/600
2	600	Whse.	Mill	250	110/220
2	500	Whse.	Mill	250	285/710
1	450	Whse.	SK	230	450/600
1	250	G.E.	CD-169	230	1150
1	200	Whse.	Mill	230	800
1	275	Whse.	QM	230	425/850
2	200/250	El. Dy.	Pod. Brg.	230	400/1200
1	200	Whse.	SK-210	230	400/800
1	180	G.E.	MFC	230	400
1	150	Whse.	SK-201	230	500/800
2	125	Whse.	SK-184	230	575/850
1	125	G.E.	MFC	230	450/800
1	100	El. Dy.	80-B	230	450/1850
1	100	El. Dy.	80-B	230	475/950
1	80	Reliance	651-T	230	575/1150
1	60/80	El. Dy.	85	230	525/1150
1	40	G.E.	CD-123	230	500/1700
1	40	Whse.	SK-140	230	500/1700
1	32 1/2	Whse.	RE-150	230	400/1200
1	25	Whse.	SK-92	230	1800
1	20	Cr. Wh.	D.P.B.B.	230	1150/2400
1	20	Whse.	SK-123	230	400/1200
1	15	G.E.	CD-85	230	575/2200
1	15	Whse.	RE-100L	230	500/1500
1	15	Reliance	155-T	230	400/1600
1	10	Whse.	SK-103	230	400/1600
1	10	Al. Ch.	E-123	230	300/1200
1	10	Whse.	RE-91	230	350/1000
1	7 1/2	G.E.	CD-75	230	600/2070
1	7 1/2	G.E.	CD-85	230	450/1350
4	5/7 1/2	Reliance	T.E.F.C.	230	337/1350

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Cable Address: "Macsteel", Philadelphia, Pa.

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Qu.	H.P.	Make	Type	Volts	Speed
1	1500	G.E.	MT	6900	1187
1	1100	G.E.	IM	2300	720
1	1000	A.C.	Mill	2300	240
1	800	G.E.	MT	2300	293
1	750	G.E.	MT-573	2200	1180
1	700	A.C.		2300	500
1	500	Whse.	CW	550	850
1	400	Whse.	CW-960A	440	1170
1	400	Whse.	CW	440	514
1	400	Whse.	CW-1213	2300	435
1	350	G.E.	IM-17A	440/2300	720
1	250	G.E.	MT-424Y	4000	257
1	250	G.E.	MT-5508	2200	1800
1	250	Al. Ch.		550	600
1	200	Cr. Wh.	20QB	440	505
1	200	G.E.	IM	440	435
1	200	G.E.	IM	2300	580
1	150 (unused)	Whse.	CW	2300	435
2	125	A.C.		440	865
1	125	Al. Ch.		440	720
1	100	G.E.	IM-16	2200	425
1	100	G.E.	IM	440	600
4	100	A.C.	ANY	440	695

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1	800	G.E.	KT-73	2200	1180
2	650	G.E.	KT-509BY	440	3570
2	450	Whse.	CR-1420	2300/4150	354
1	400	G.E.	IE-15B	2200	1165
1	400	G.E.	IK	2200	1200
1	200	G.E.	IK-17	440	580
3	200	G.E.	KT-557	440	1800
1	150/75	G.E.	IK	440/900/450	
1	150	Whse.	CS-6508	440	580
1	150	Whse.	CS	440	580
2	125	Al. Ch.	ARW	2200	1750

SYNCHRONOUS

Qu.	H.P.	Make	Type	Volts	RPM
1	7000	G.E.	ATTI	2500/6600	600
1	4350	C.W.	3501RL4000/6900/13900	514	
1	2850	Whse.	.8 p.f.	2300/4600	514
1	2000	Whse.	.8 p.f.	2300	720
2	2000	Whse.		2300	120
2	1750	G.E.	ATTI	2300	3600
1	735	G.E.	ATTI	2200/12000	600
1	500	G.E.	TR-7507	2200	1200
1	450	Whse.		2200	128.5
1	450	Whse.		2200	450
1	400	G.E.	TR-7505	2200	1200
1	325	G.E.	ATTI	440	1800
1	225	G.E.	ATTI	440	1800

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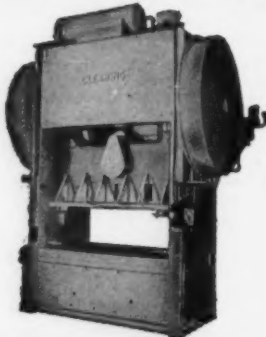
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450	*Al. Ch.	ARW	1800
400	G.E.	KT-424	720
300	G.E.	KT-6353 TEFC	720
250	Westg.	CS-TEFC	1800
250	G.E.	KT-559	1800
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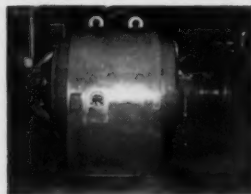
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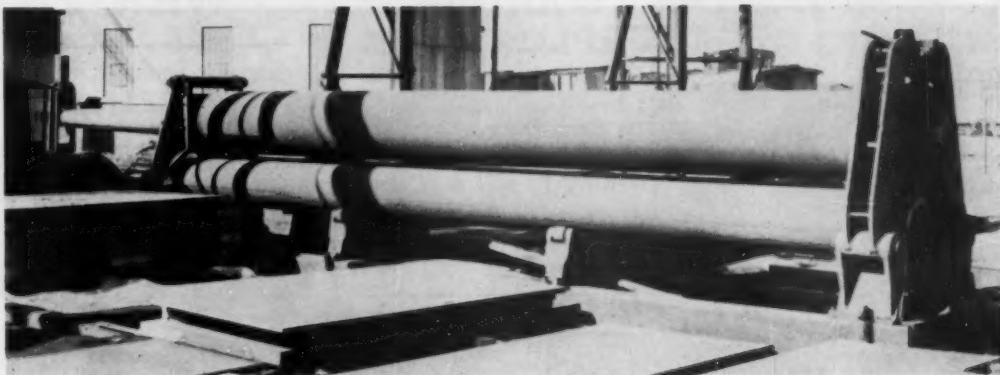
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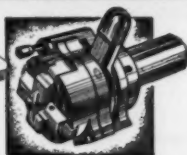
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METALWORKING BRIEFS

Industrial Furnace Orders Drop

Orders for industrial furnaces during May totaled \$3,620,221 for member companies of the Industrial Heating Equipment Assn. This is a decline of 42 pct from May of 1955, but total business for the first five months of the year is 32 pct ahead of record-breaking 1955. Total for the period is \$41,855,482.

Alcoa Starts Labor Talks

Aluminum Co. of America opens formal contract negotiations this week with United Steelworkers of America for 17,000 workers in 12 plants. Present contract expires July 31. Last year the union obtained a 15¢ hourly wage increase, similar to the contract in the steel industry.

Business Gets Boost from Exports

Goods and services exported from the U. S. in the first quarter of this year totaled \$5.3 billion, according to the Dept. of Commerce. This represents an increase of \$600 million over the same period in 1955. The Commerce Dept. calls the high level of exports "an important element in supporting the high rate of domestic business activity" in the period.

Steel Labor: Straw In The Wind?

Would the United Steel Workers settle for a 3-year contract? (See page 51.) In this regard, veteran observers attach some significance to a message this week from a local union of Jones & Laughlin employees in Pittsburgh. The local wired David J. McDonald, union president, it is behind him should he negotiate a good 3-year agreement.

TV: Tool For Safety Education

Closed-circuit television has made its debut as a tool for plant safety education. U. S. Steel Corp. management employees and their wives received face-to-face safety messages via a TV hookup embracing 10 cities. Clifford Hood, president of U. S. Steel, spoke from New York.

Boral Available for Nuclear Shielding

Companies working on atomic energy installations may now obtain boral, a neutron shielding material, in larger plates and sheet sizes than ever before produced. The Aluminum Co. of America has developed a fabricating procedure that now provides the large sizes.

ADVERTISERS

An asterisk beside the name of advertiser indicates that a booklet, or other information, is offered in the advertisement. Write to the manufacturer for your copies today.

A		D	
A-I Steel Company	181	Darwin Paper Co.	44
Ajax Electric Co., Inc.	4	Crucible Steel Co. of America ..	87
Ajax Electric Furnace Corp.	4	*Curtiss-Wright Corporation, In-	32
Ajax Electro Metallurgical Corp.	4	ustrial and Scientific Division	
Ajax Electrothermic Corp.	4		
Ajax Engineering Corp.	4		
Ajax Flexible Coupling Co.	89		
Allied Research Products Inc.	81		
Between Pages 80 & 81			
Allis-Chalmers Mfg. Co.	22		
*Allis-Chalmers Mfg. Co.	22		
Buda Division	31		
American Chemical Paint Co.	133		
*American Pulverizer Co.	92		
Armel, James P.	179		
*Armstrong-Blum Manufacturing	78		
Co.			
*Armstrong Bros. Tool Co.	183		
Atlas Mineral Products Co.	95		
B		E	
Baldwin-Lima-Hamilton Corp.	43	Eastern Machine Screw Corp., The	183
*Barksdale Valves	185	Eastern Machinery Co., The	179
Belyea Co., Inc.	177	*Eaton Mfg. Co., Reliance Div.	10
Bennett Machinery Co.	177	Enthone Incorporated	129
Beulah Steel Co.	1	*Erie Foundry Co.	16
Birdsboro Steel Fdry. & Machine	40	*Eriez Manufacturing Co.	35
Co.		Espen-Lucas Machine Works, The	183
Blaw-Knox Company, Foundry &	17	Eveready Supply Co.	179-181
Mill Machinery Division			
Bolling, Stewart & Co., Inc.	179		
*Bronson Ultrasonic Co., Division	130		
of Bronson Instruments Inc.			
Brazos Engineering Co., Inc.	180		
Brown & Sharpe Mfg. Co.	76		
Browning, Victor R. & Co., Inc.	183		
Bucyrus-Erie Co.	36		
*Buffalo Forge Co.	24		
Burt Mfg. Co., The	86		
C		F	
Capitol Mfg. & Supply Co.	182	Fabrikant Steel Products, Inc.	178
Carlson, G. O., Inc.	37	Falk Machinery Co.	177
Carpenter Steel Co., The	29	Farval Corporation	50
Cattie, Joseph P. & Bros.	183	Federal Machine & Welder Co.	186
*Chemical Corp.	138	*Fenn Manufacturing Co., The	13
Chicago Electric Co.	179	Fenway Machine Co., Inc.	155
Cincinnati Milling Machine Co.,	74	Fischer Special Mfg. Co.	152
The, Process Machinery Division		Fort Dodge, Des Moines &	181
*Cincinnati Shaper Co., The	23	Southern Railway Co.	
Cities Service Oil Co.	85	Foster, Frank B., Inc.	179
*Clark, Cutler, McDermott Co.,	88	Fostoria Pressed Steel Corp.	147
Air-Loc Division		Frank, M. K.	180
*Clearing Machine Corp. Div.,	67		
U. S. Industries Inc.			
*Cleveland Crane & Engineering	26		
Co., The Steelweld Machinery			
Div.			
Colorado Fuel & Iron Corp., The	20 & 21		
Wickwire Spencer Steel Div.			
Columbia-Geneva Steel Div.,	163		
United States Steel Corp.			
Concord Real Estate Co.	181		
Continental Foundry & Machine	17		
Division of Blaw-Knox Co.			
Copper & Brass Research Associa-	80		
tion			
Cowles Tool Co.	84		
Crawford, F. H. & Co., Inc.	178		
G		H	
General Electric Co., Chemical &	27	*Harshaw Chemical Co.	135
Metallurgical Division		Hayward Company, The	183
Globe Steel Abrasive Company,	132	Heat & Power Co., Inc.	178
The		Hendrick Manufacturing Co.	150
Goodman Electric Machinery Co.	179	Henry, A. T. & Company, Inc.	177
Goss & DeLeeuw Machine Co.	183	Hughes, Arnold Co.	180-182
Greenpoint Iron & Pipe Co., Inc.	180	Hydraulic Press Mfg. Co., The,	91
Griffin Manufacturing Co.	183	Metal Working Division	
I		Hyman, Joseph & Sons	178
*International Nickel Co., Inc.,	167		
The			
Iron & Steel Products, Inc.	176		

IN THIS ISSUE

K

Kasie Steel Corp.	180
Kinderman, Lou F.	178
Kocour Co.	144

L

Lamson & Sessions Co., The	12
Land, L. J., Inc.	178
*Landis Machine Co., Inc.	42
Lang Machinery Co.	179
*La Salle Steel Co.	70
Lees-Bradner Co., The	33 & 34
*Loewy-Hydropress Division, Baldwin-Lima-Hamilton Corporation	43
Low Bros. Co., The	149
Luria Bros. & Co., Inc.	165

M

McLouth Steel Corp.	Between Pages 80 & 81
MacCabe, T. B. Co.	177
Mac Dermid, Inc.	146
Mackintosh-Hemphill Division of E. W. Bliss Company	63
Martin, Joe, Co., Inc.	180
Meriwether, George M.	179
Mesta Machine Co.	96
Metalwash Machinery Corp.	182
Metal & Thermit Corp.	69
Miles Machinery Co.	177
Monarch Machine Tool Co.	45
Morrison Railway Supply Co.	180
*Molch & Merryweather Machinery Co.	8

N

National Business Bourse, Inc.	182
National Machinery Exchange	178
National Steel Corp.	139
*New Departure Div., General Motors Corp.	48
*Niagara Machine & Tool Works	46 & 47
Norfolk and Western Railway	30
*Norton Company	148

O

*Oakite Products, Inc.	140
Ohio Ferro-Alloys Corp.	5
Orchard Paper Co.	143
Ornits Equipment Corporation	179
Ovingsteel Inc.	9

P

Pangborn Corp.	142
Peninsular Grinding Wheel Division, Abrasive and Metal Products Company	141
Pittsburgh Steel Co., Thomas Strip Div.	Between Pages 16 & 17
Platt Bros. & Co., The	183
Pratt & Whitney Co., Inc.	14 & 15
Price Brothers Company	181
Purdy Company, The	180

R

Rail & Industrial Equip. Co., Inc.	180
Ronsburg Electro-Coating Corp.	136
*Rapid Electric Co.	155
Reisberg's Iron & Metal Co.	181

*Republic Steel Corp. 18 & 19, 30 & 39

Roots-Connersville Blower Division

Dresser Industries, Inc. 72

S

S. & S. Machinery Co.	181
Seymour Manufacturing Co., The	11
Sharon Steel Corp.	6
*Speed-D-Burr Corporation	134
Standard Pressed Steel Co.	44
Stanhope, R. C., Inc.	180
Steelweld Div., The Cleveland Crane & Engineering Co.	26
Stupakoff Division of The Carborundum Company	182

T

Tennessee Coal & Iron Div.	163
United States Steel Corp.	94
*Thomas Flexible Coupling Co.	82
Timken Roller Bearing Co., The	178
Tipkins Machinery Co.	158
*Torrington Co.	151
Needle Bearing Div.	131
*Townsend Company, The	131
Turco Products Incorporated	131

U

United Chromium Division	69
Metal & Thermit Corp.	163
United States Steel Export Co.	163
*United States Steel Corp.	163
United States Steel Supp'y Div.	163
United States Steel Corp.	163

V

Verson Allsteel Press Co.	Back Cover
---------------------------	------------

W

*Wagner Electric Corp.	28
Wallack Bros.	182
Ward Steel Co.	9
Warner & Swasey Co.	41
Watson-Stillman Press Division Farrel-Birmingham Company, Inc.	93
Weinberg, I., Co.	180
Weirton Steel Co.	139
Weiss, B. M., Co.	181
Weiss Steel Co., Inc.	182
Wheeling Steel Corp.	25
*Whiting Corporation	Inside Front Cover
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp.	20 & 21
Wilson, Lee, Engineering Co., Inc.	Inside Back Cover
Wyandotte Chemicals Corp.	145
Wyatt, C. G. Company, Inc.	181

Y

Youngstown Welding & Engineering Co.	41
--------------------------------------	----

CLASSIFIED SECTION

Clearing House	176-181
Contract Manufacturing	Appears in first and third issue of each month. See June 7 & June 21
Employment Exchange	182
Equipment & Materials Wanted	182

STOP CYLINDER CREEP

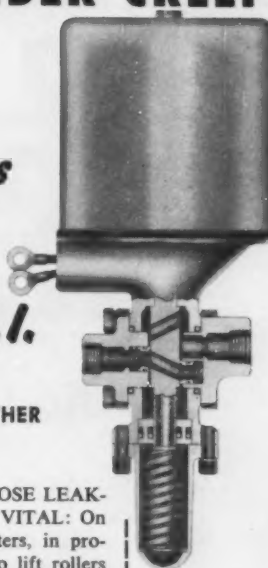
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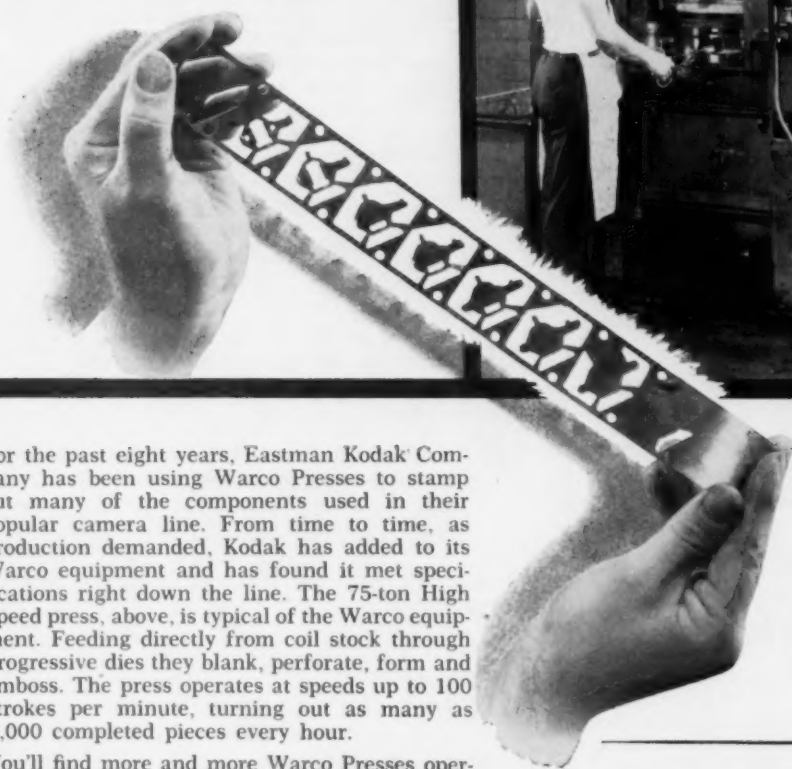
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**help Kodak make
precision cameras**



For the past eight years, Eastman Kodak Company has been using Warco Presses to stamp out many of the components used in their popular camera line. From time to time, as production demanded, Kodak has added to its Warco equipment and has found it met specifications right down the line. The 75-ton High Speed press, above, is typical of the Warco equipment. Feeding directly from coil stock through progressive dies they blank, perforate, form and emboss. The press operates at speeds up to 100 strokes per minute, turning out as many as 6,000 completed pieces every hour.

You'll find more and more Warco Presses operating in plants, like Eastman Kodak where quality and long, trouble-free service are appreciated. *The Federal Machine and Welder Co., Warren, Ohio.*

Progressive die sample of pull-down claws for Kodak's Cine-Kodak Medallion 8 Camera. Warco Press produces about 6,000 per hour.



Cine-Kodak Medallion 8



Brownie Holiday Flash



Brownie Hawkeye



9872



The Federal Machine and Welder Company

WARREN, OHIO

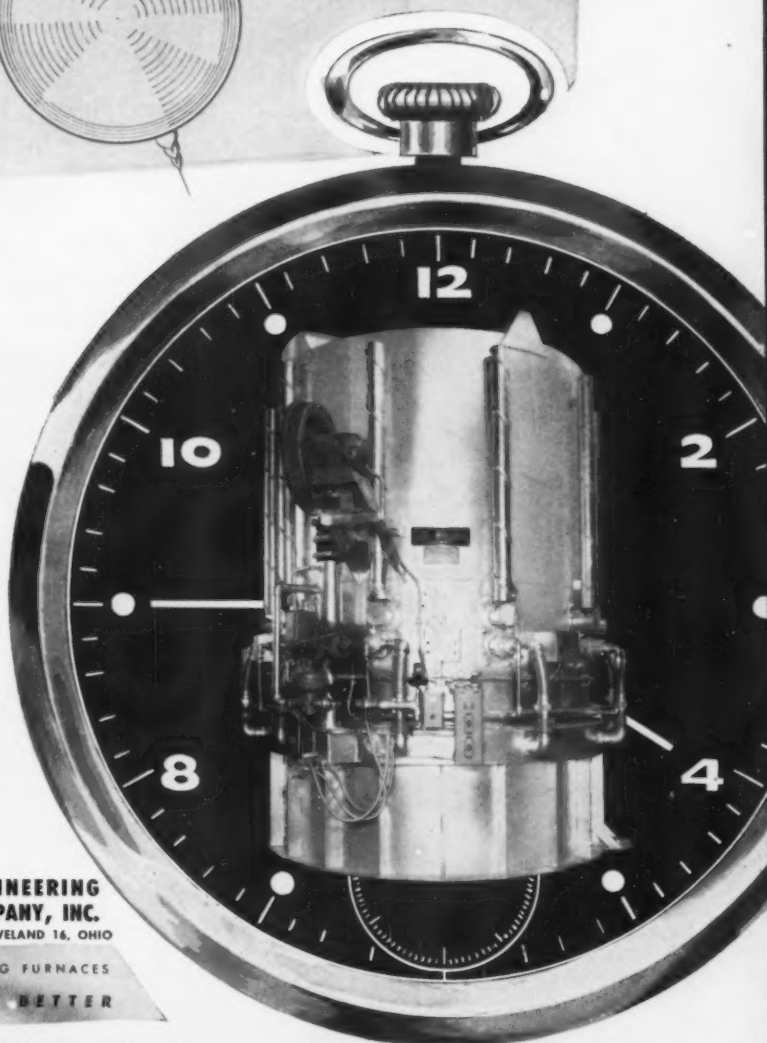


Progress is inevitable...

**From eight-stack to four-stack
—to single-stack . . . that's the
way of progress in steel coil
annealing.**

Some years ago, larger steel producers were annealing in eight-stack furnaces. Then it was discovered they could actually get more work out at lower costs by reducing the size of the furnace to half. Now, these same devotees of high production are finding they can boost output per pedestal 50 per cent or more by reducing the furnace operation to a single stack of coils, and effect substantial savings in the bargain.

Wilson engineers have made great efforts to gather cost and efficiency data from leading mills for both single and four-stack installations. These reports prove beyond a doubt that a complete single stack installation is the fastest and least expensive to install, maintain and operate, with the quality which must result from truly automatic temperature control for every stack of coils.



Lee Wilson^{*}

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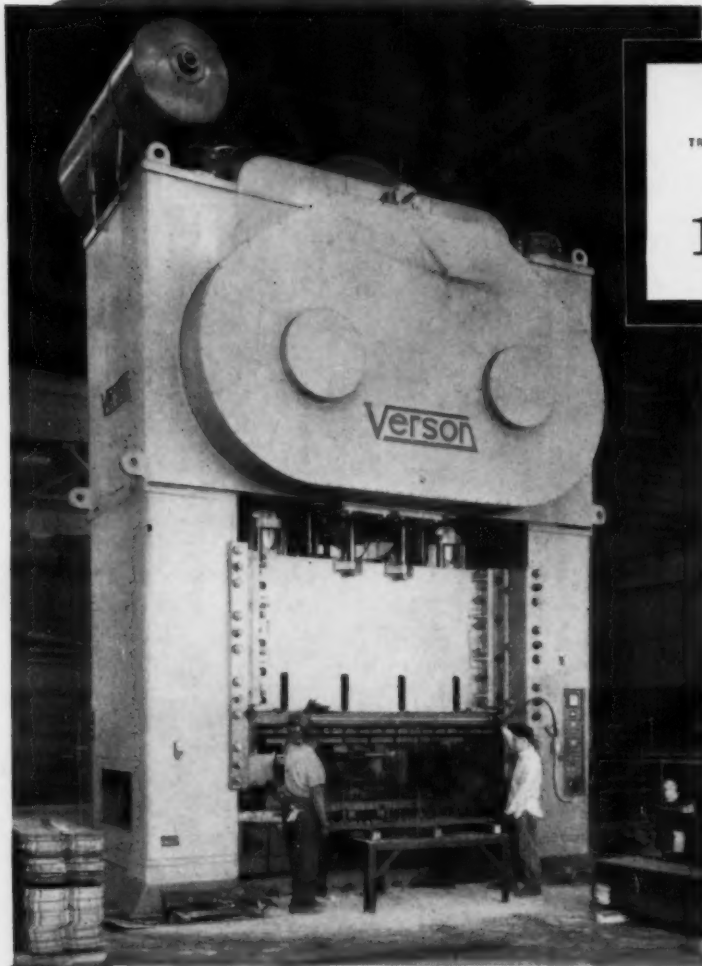
SINGLE-STACK RADIANT TUBE ANNEALING FURNACES

MAKE THE BEST METALS BETTER

* ORIGINATORS AND LEADING PRODUCERS OF SINGLE-STACK RADIANT TUBE FURNACES

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Front to Back Crank Arrangement of this



TRADE **Verson** MARK 1800 Ton Press

eliminates
need
for
extra long
shaft

Verson Presses offer features that bring accuracy, dependability and economy to a wide range of metal forming operations. The Verson Allsteel Frame, anti-overlap clutch and brake unit, square type gibs and non-oscillating vertical type adjusting screw are examples of the engineering and design that are a part of every Verson Press.

The press illustrated is a Verson 1800 Ton, twin gear, double crank. Two crankshafts are arranged front to back to eliminate the necessity of an extra

long crankshaft. Gearing for the press can be installed and removed through the front of the crown allowing installation in areas with low overhead clearance. The machine was built to J.I.C. standards and has all electrical wiring and equipment, lubrication piping, air piping and controls installed internally.

We will be pleased to recommend Verson Presses to fit your production process. Just send an outline of your requirements.

A Verson Press for every job from 60 tons up.



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